Grinding and Finishing

WHEELS • GRINDING • HONING • LAPPING MACHINES • ACCESSORIES • PORTABLE GRINDERS • TUMBLING • ABRASIVES

The Magazine Devoted Exclusively to Abrasive Operations

JUL -6 1955

★ FEATURES

How Grinding Standards Are Established With Standard Data . . . part 1

A Modern Perspective of the Grinding Process

Crush Dressing and Grinding on a Surface Grinder

How Foundries Can Reduce Their Grinding Costs

ALSO IN THIS ISSUE

Tool and Cutter Grinding Department

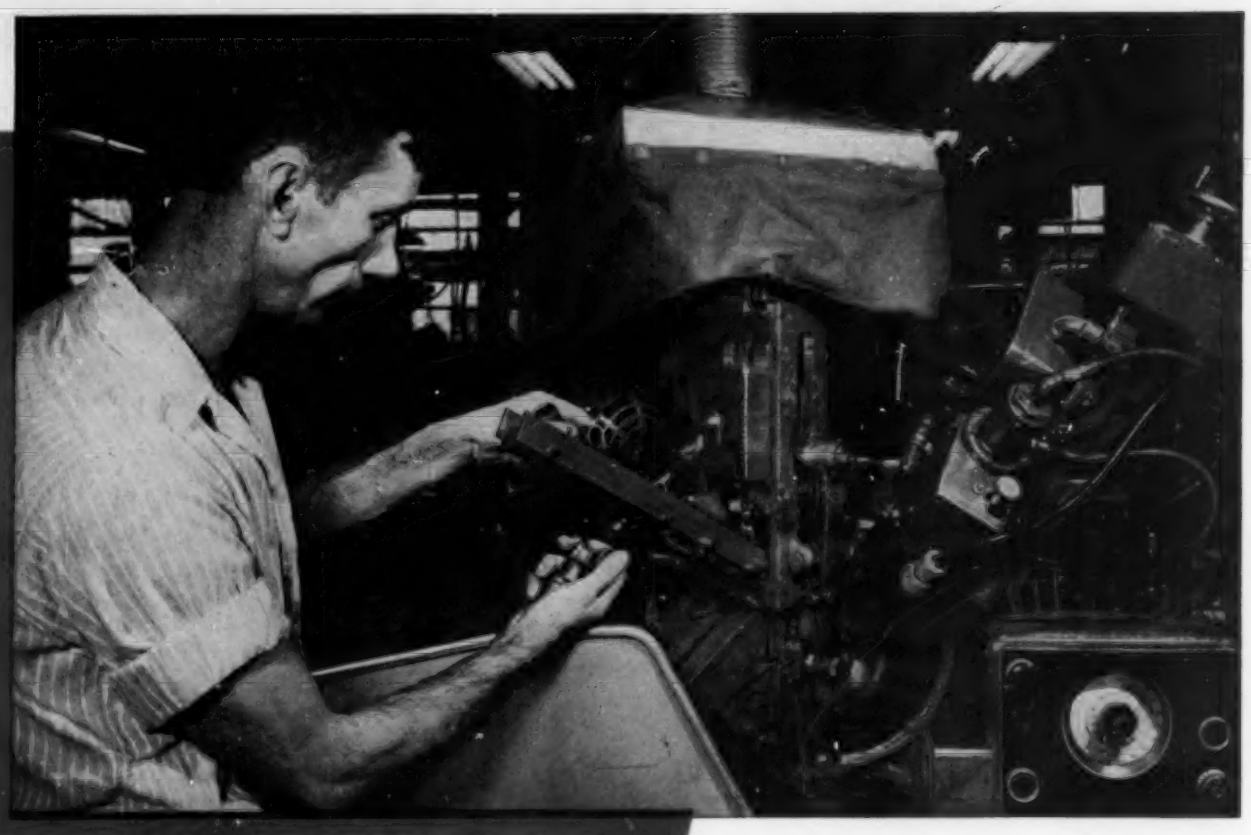
Safety Department

Shop Hints

Pages from Ronnie Burritt's Notebook

Hitchcock publication

May 1955



HOW BETTER LUBRICATION INCREASED PRODUCTION

for Tyson Bearing Corporation, Massillon, Ohio

THE JOB is grinding O. D. of bearing cones. Four micro-centric grinders are used.

BEFORE TEXACO was used, the sleeve bearings in the grinding and work spindles lasted only about three weeks, and production was off due to excessive machine downtime. Cause of bearing failure was contamination of spindle lubricant by the grinding oil, resulting in ineffective lubrication.

AFTER TEXACO *Cleartex Oil* was installed—to be used as both grinding oil and machine lubricant—the improved lubrication eliminated bearing failures. *There hasn't been one now for over a year!* And with *Texaco Cleartex Oil,* Tyson can get as many as twenty pieces (with better finish) per wheel dressing—as against the ten or twelve previously obtained.

These benefits are typical wherever Texaco takes over. There is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the right ones for your jobs.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring DONALD O'CONNOR or JIMMY DURANTE on television . . . Saturday nights, NBC.

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MAY 1955 — VOL. 1 NO. 1A

Grinding and Finishing

TJ1280
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Hitchcock District Managers are listed on page 9.

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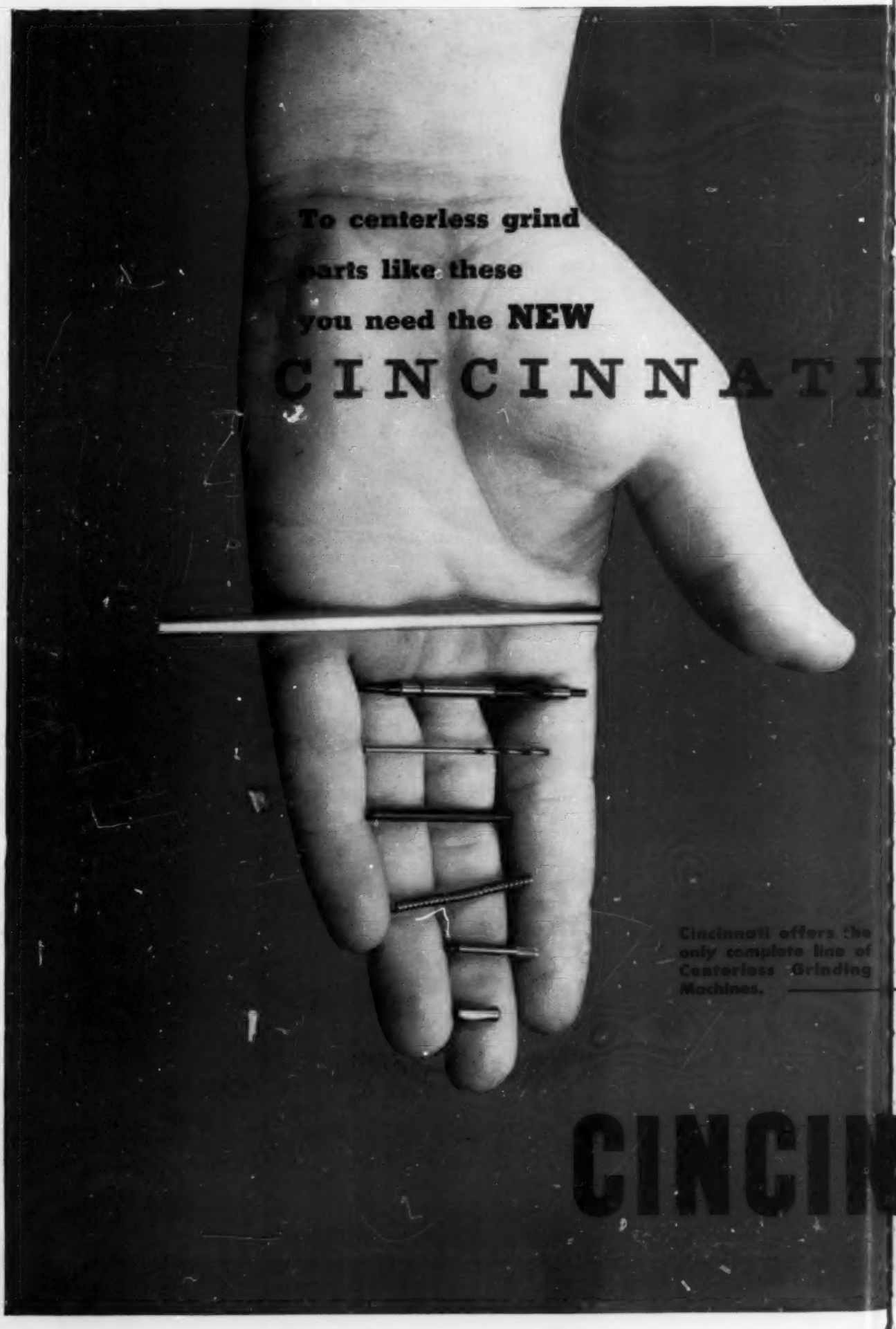
To centerless grind
parts like these
you need the NEW
CINCINNATI
Cincinnati offers the only complete line of Centerless Grinding Machines.
CINCIN

Keeping the cost of precision grinding in line with the size of small parts is often quite a job. Now you can do something about it. CINCINNATI FILMATIC No. 0 Centerless Grinders are completely new, designed specifically for small work up to ½" diameter. They require but little floor space, only 63" x 61½", yet the machine is ruggedly constructed to remove metal rapidly up to the full capacity of the 5 hp grinding wheel drive motor. ¶ There are a number of reasons why these new CINCINNATIS are such efficient, low-cost producers:

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New CINCINNATI FILMATIC No. 0 Centerless Grinding Machine, Catalog No. G-640 contains complete specifications.

FILMATIC No. 0

FILMATIC

a) FILMATIC bearings for the grinding wheel spindle run for years without servicing or adjustment

b) Double slide construction between bed and regulating wheel housing simplifies setups; facilitates infeed grinding

c) Automatic and oil-shot lubrication

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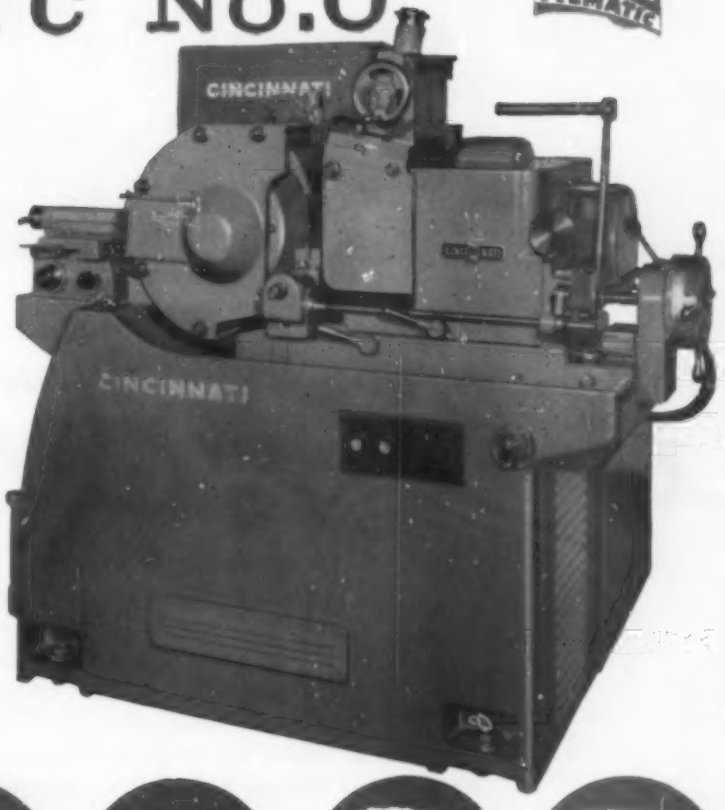

Would you like to know more about new CINCINNATI FILMATIC No. 0 Centerless Grinders, and how they can reduce the cost of small precision parts? Write for catalog No. G-640.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

No. 0	No. 2	No. 3	No. 4	No. 5	No. 6
5 hp	15 hp	25 hp	30 hp	Up to 75 hp	Up to 75 hp

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CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

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Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

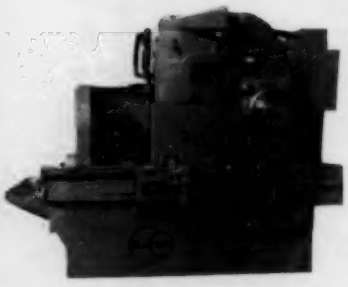
Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to **"PUT IT ON THE BLANCHARD".**

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!



Send for free copies of "Work Done on the Blanchard", (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

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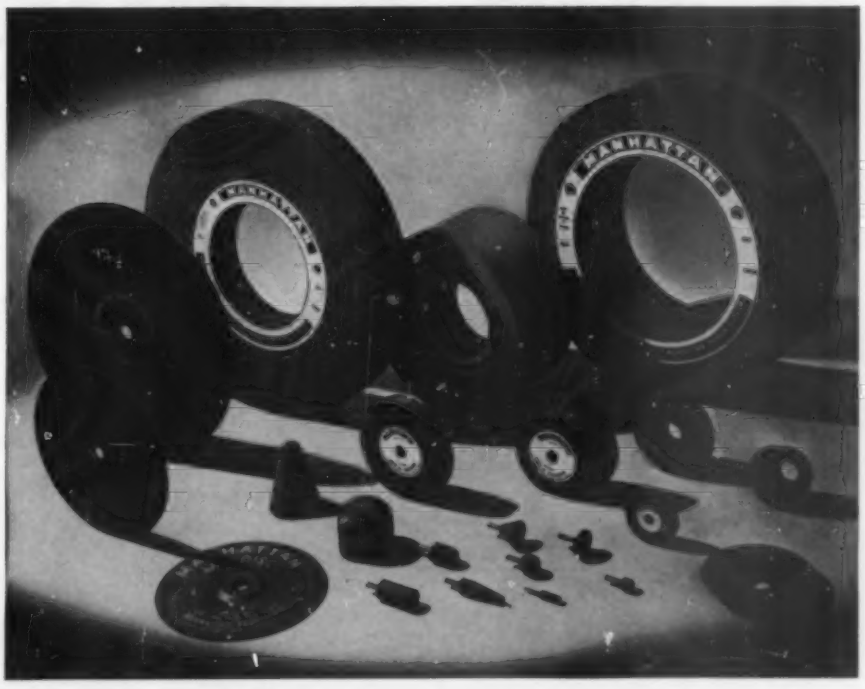
HOW TO BUY ABRASIVE WHEELS

FOR MORE METAL REMOVAL

. . . and get

"More Use per Dollar"

Insist on abrasive wheels that are engineered for your particular grinding or finishing requirements . . . custom-bonded to remove *more* metal, faster, at *lower* cost. Specify, by name, the abrasive wheels engineered with *your* job in mind . . . specify Manhattan Abrasive Wheels.



MANHATTAN ABRASIVE WHEELS

Every component of the Manhattan Abrasive Wheel you buy — type of abrasive, grain size, hardness, structure and bond — is determined by the specific requirements of your job application. Whatever your needs a Manhattan wheel can be designed and built to solve the problems at your plant, specifically for light metals and alloys.

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DISCUSS YOUR METAL REMOVAL REQUIREMENTS WITH A MANHATTAN REPRESENTATIVE. HE CAN SHOW YOU HOW YOU CAN REMOVE MORE METAL, FASTER . . . GET "MORE USE PER DOLLAR"—MORE OUTPUT PER MAN-HOUR—WITH MANHATTAN ABRASIVE WHEELS.

RM-544

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MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

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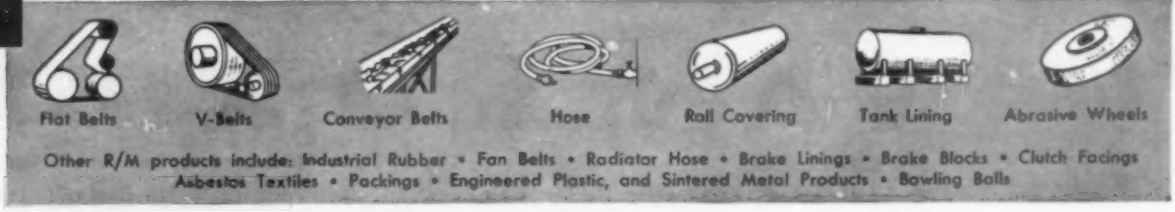

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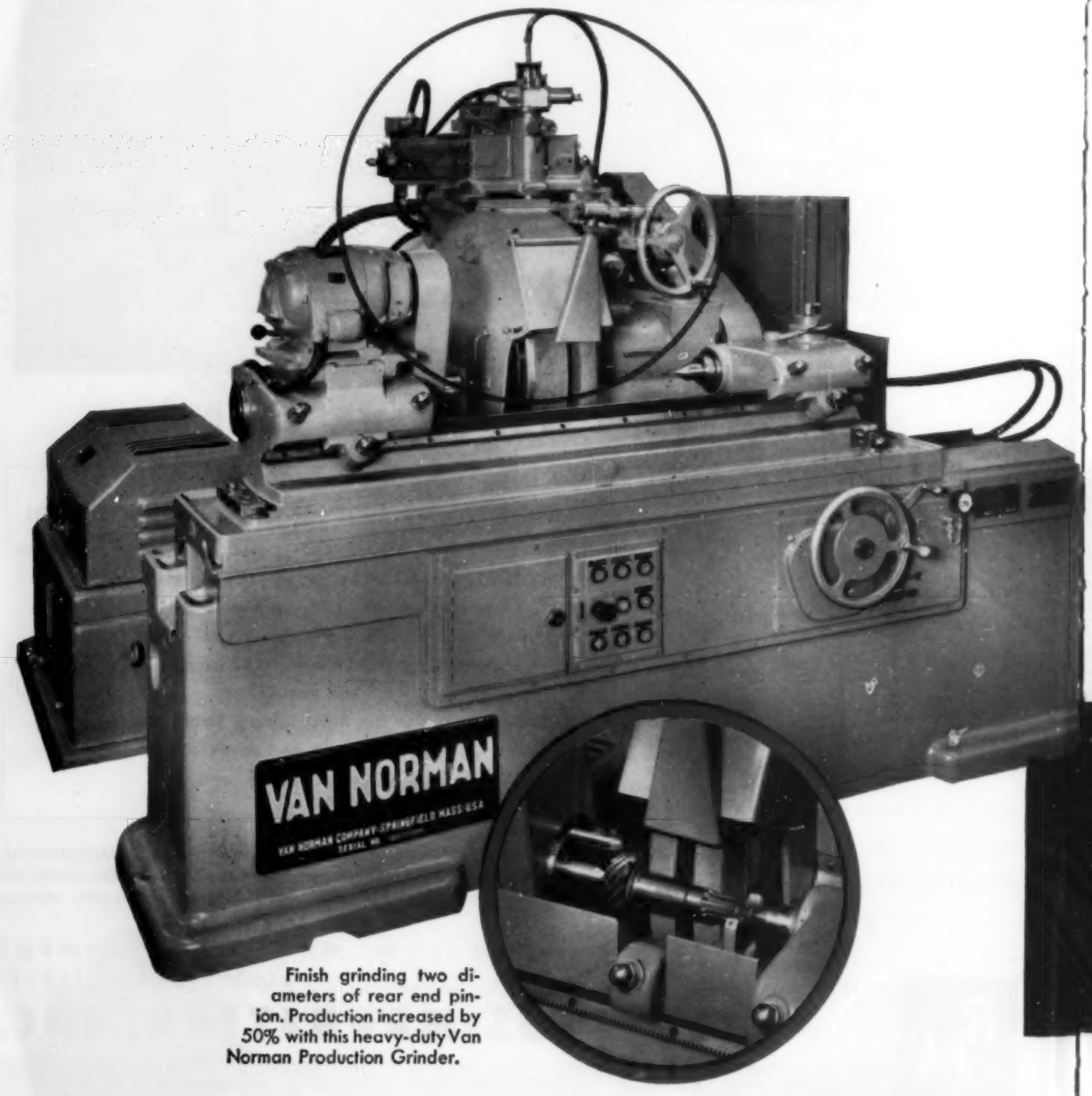
Leading Automobile

INCREASES

...with Van Norman



Finish grinding two diameters of rear end pinion. Production increased by 50% with this heavy-duty Van Norman Production Grinder.

VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Manufacturer

PRODUCTION 50%

Production Grinders

8 TONS OF MASSIVE RIGIDITY

Like all Van Norman Production Grinders this rugged, heavy-duty machine is precision engineered and built to assure maximum grinding accuracy at high production rates.

You, too, can boost grinding output, cut costs with Van Norman Special Production Grinding machines. They can be designed with single or double head grinding wheel units. Our engineers will gladly work with you on your particular problems. Write for their assistance.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on four purchase plans — Outright Sale . . .Purchase on conditional sales contract up to 5 years . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

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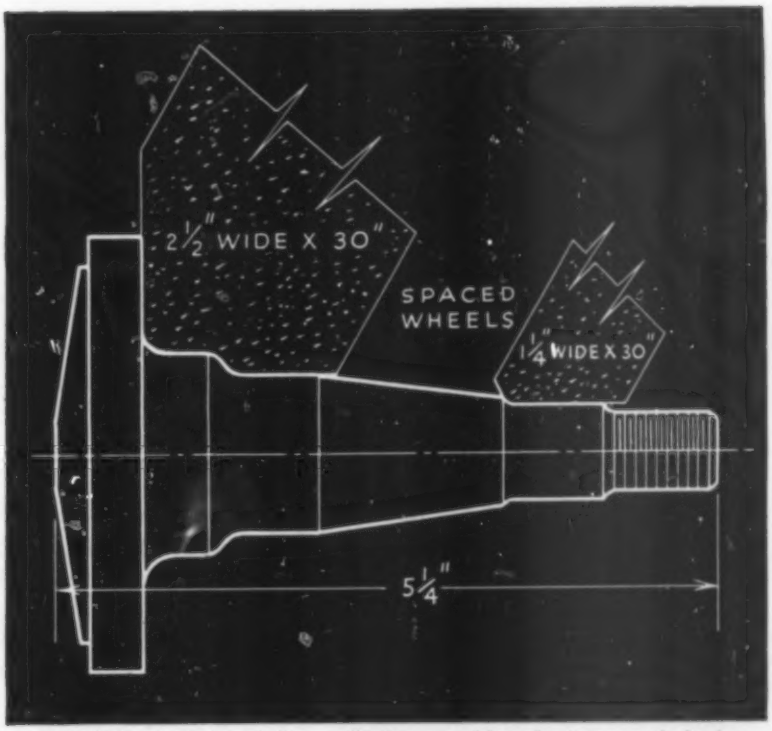
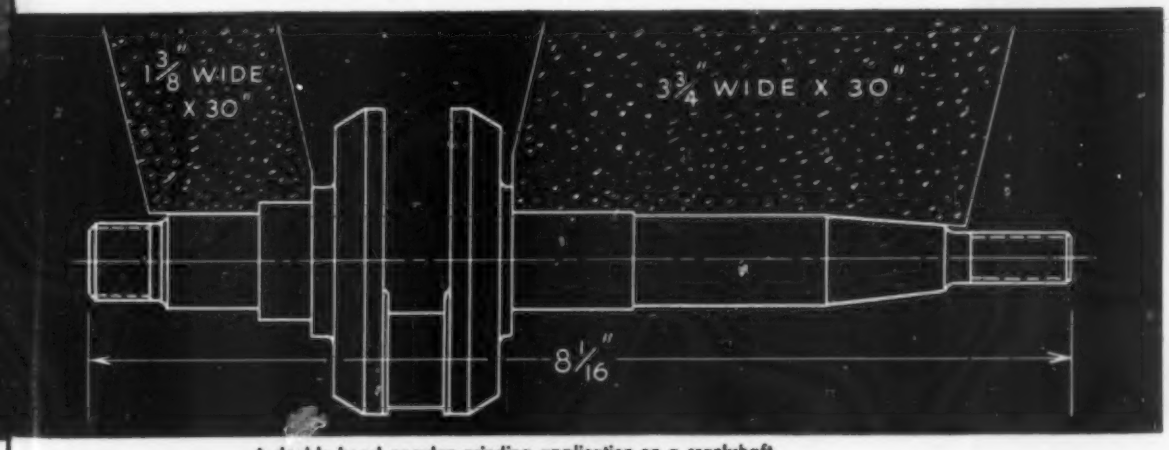


A single head angular grinding application on a pinion using two spaced wheels.



A double head angular grinding application on a crankshaft.

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SPRINGFIELD 7, MASSACHUSETTS

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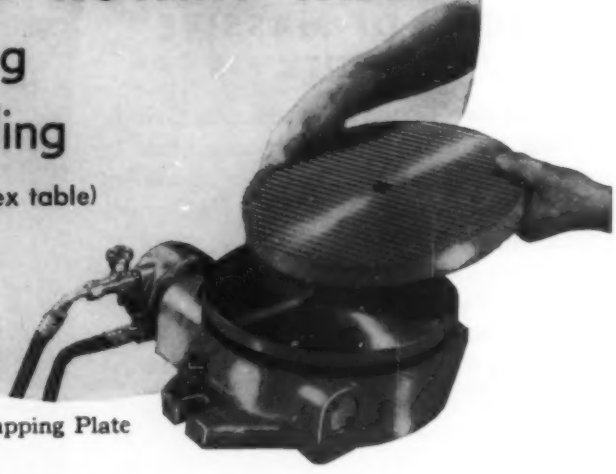
With Permanent Magnetic Chuck

NEW *Vulcan* MOTORIZED ROTARY TABLE

for lapping and grinding

(not an index table)



With Lapping Plate

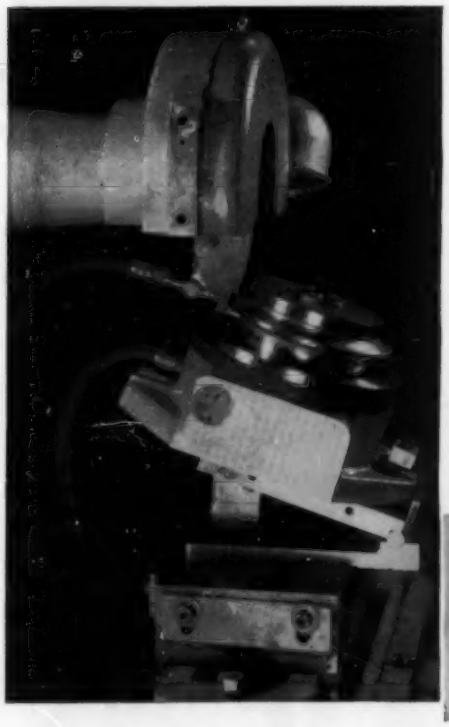
FASTER
circular precision grinding!

Now with this table and with less effort you assure highest standards of accuracy, flatness, finish and close tolerances. At the same time you eliminate slow and complicated tool setups. You cut grinding time greatly by using only cross feed while the table is rotating at infinite speeds between 40 and 100 RPM.

For example, Vulcan's Rotary Table can be used in connection with a sine plate or angle fixture. The dressing of large expensive external wheels for side grinding is therefore eliminated. If you wish we can provide permanent magnetic chucks designed for use with our table, both 6" and 10" in diameter.

Vulcan's Rotary Table is an air operated, self contained unit, portable between bench or machine. A precision center hole for locating and tapped holes in the table for clamping provides easy setup. Circular surface grinder applications are many and varied — grind flanged studs or bushings — bearing spacers — forming rolls — cutters — convex or concave surfaces — punches or dies (radius or angle).

Lapping? Yes — and in micro inches. For the 6" and 10" table, lapping plates of 12" and 16" are provided. Perfect for lapping valve plates, gages, bearing spacers and for carbide lapping using diamond powder. *Write for circular.*



Work clamped to motorized table, mounted on sine plate. Surface grinder application.

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VULCAN TOOL CO.

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PRECISION'S EXCLUSIVE NEW WHEEL
for TOOL & CUTTER and SURFACE GRINDING

- It cuts faster, giving greater stock removal.
- It cuts freer with a minimum of wheel wear.
- It's sharper permitting heavier cuts.
- It holds its shape longer, meaning fewer dressings.
- It greatly reduces grinding costs.
- It's the only wheel of its kind on the market.
- It's immediately identifiable as PRECISION.

Contact our local representative for specifications and additional information.

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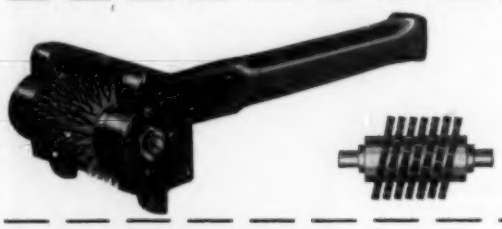

Desmond Heavy Duty dressers—ball bearing equipped, for use on large high speed wheels, particularly of resinoid or rubber bond.

Desmond Beltbrasive dressers—lengthen life of abrasive belts, discs, drums by removing the load, uncovering cutting edges of grit.

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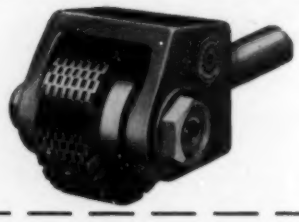
Desmond Diamond tools—a full line of hand tools and nibs. Prompt remounting service on diamond dressers.



Desmond Precision dressers—for precision dressing of wheels on surface and machine grinders. Replace diamonds in some applications. Also furnished in Cincinnati Centerless type.

Desmond cutters—We make cutters for all types of dressers. Shown here is a set of Desmond Huntington cutters. Tell us your needs.

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◀ *Mail us a copy of your new No. 75 Desmond Dresser Catalog and name of our nearest industrial distributor.*

THE ONLY COMPLETE LINE OF GRINDING WHEEL DRESSERS AND CUTTERS

Desmond

THE DESMOND-STEPHAN MFG. CO., URBANA, OHIO

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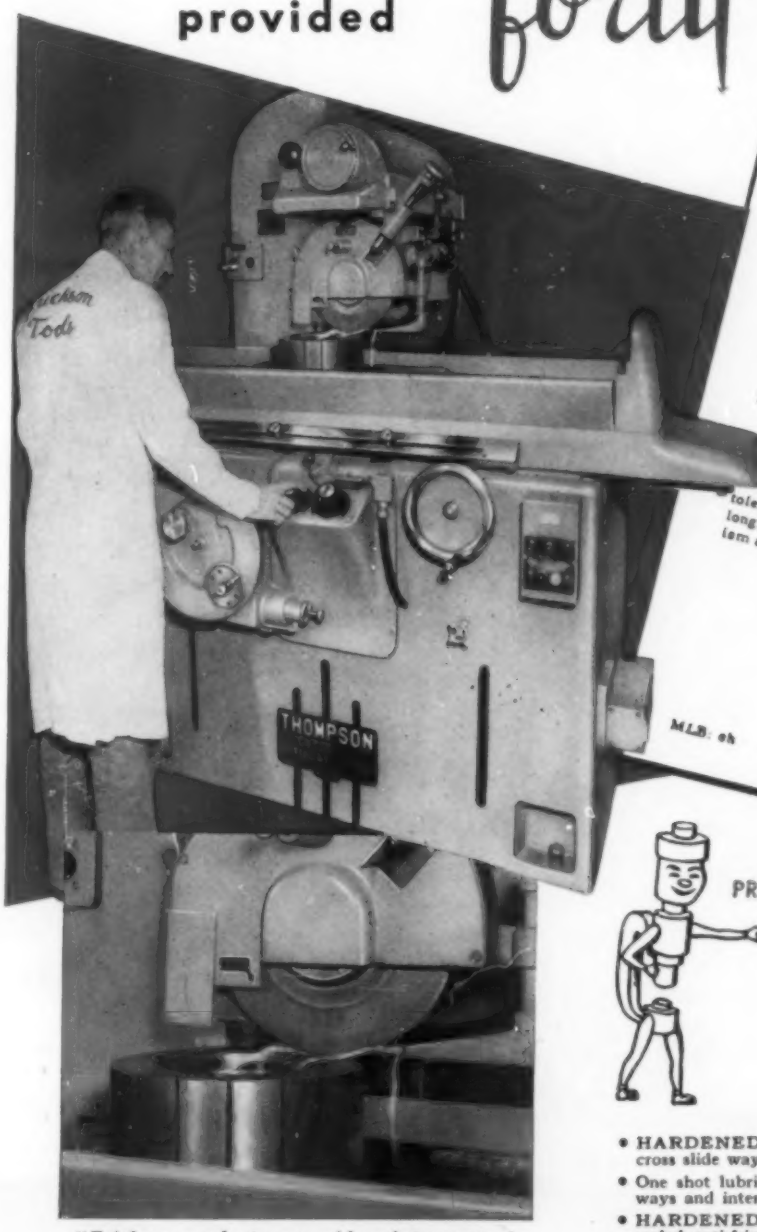
The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 83RD AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism else. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

M.L.B. eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 **R.P.M.** 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

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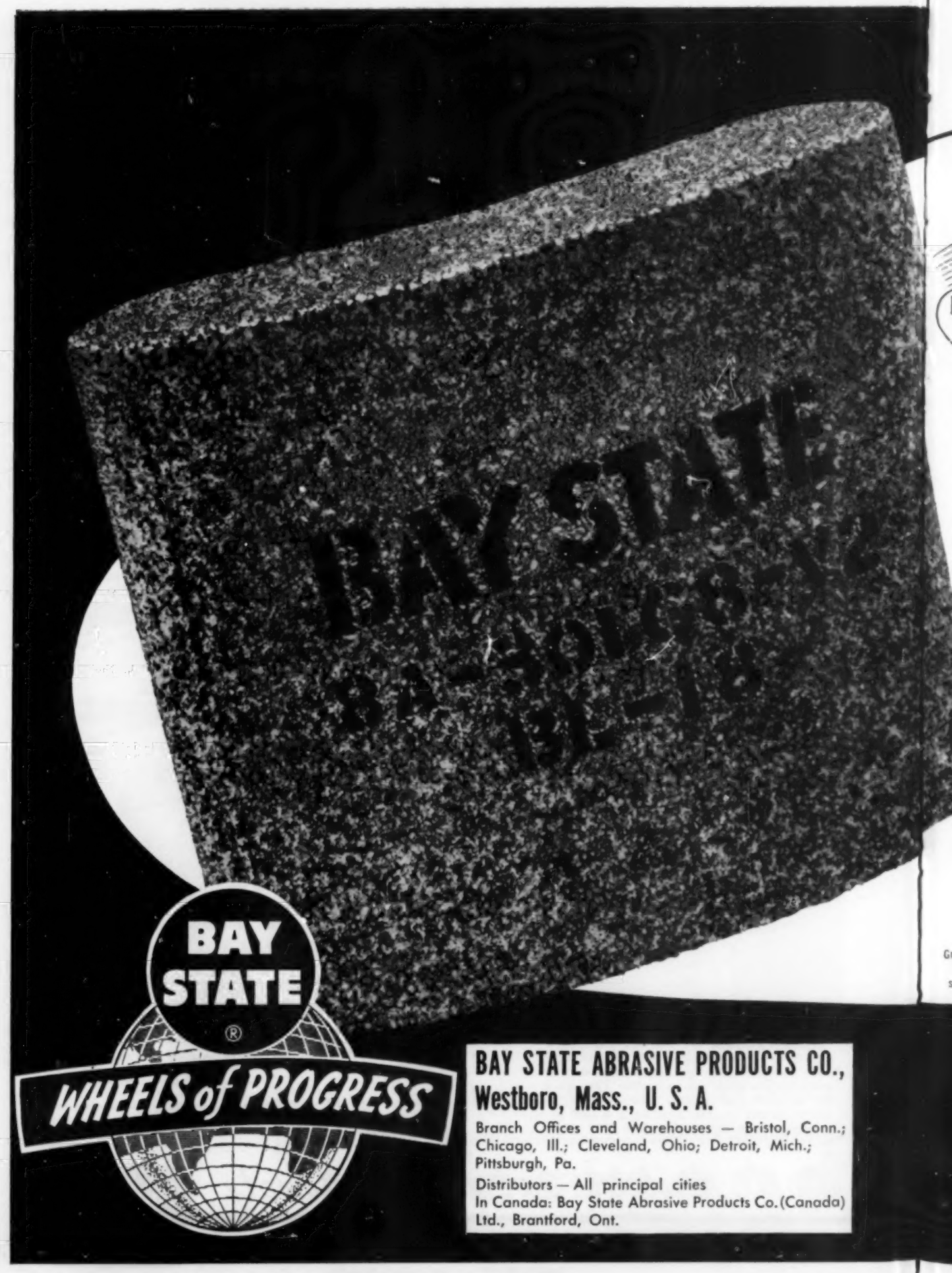

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Distributors — All principal cities
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WITH 1 "SPEC"... 3 METALS!

It took BAY STATE segments *and* engineering to lick this problem for a New England manufacturer! Distributor abrasive engineer Jack Somers did it, and gave the customer *extra* values too.

Here's how this problem was solved

Gear blanks, timing gear cases, transmission housings and other products . . . some of steel (both hardened and soft), some of aluminum, and others of cast iron . . . all had to be faced on rotating-table surface grinders. Obviously, savings could be made *if* the same set of segments could satisfactorily grind and finish all three metals.

Mr. Somers, using his specialized technical knowledge, proved it *could* be done . . . with the BAY STATE 8A-301G8-V2 specification.

Results: Cutting Action: EXCELLENT, on all three metals.

Segment Life: MORE THAN DOUBLE that of competitive specifications.

An *extra* value was the low cost of the "8A" abrasive, BAY STATE'S economy abrasive mixture which gives premium cutting characteristics at non-premium price.

Bay State can solve your grinding problems

Grinding gear case. Note how strobo-flash photo stops motion of coolant

Request BAY STATE'S free, "On-The-Job" engineering service (see coupon below), available through your local distributor, our district offices, or from Westboro.

This top-flight engineering service plus all the BAY STATE product superiorities, such as Fractional Grades (3 degrees of hardness within a single normal grade), Controlled Porosity, and the economy abrasive "8A" can bring about the solution to your grinding problems.

BAY STATE WHEELS of PROGRESS

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Please send us Surface Grinding literature. ☐

We have a grinding problem. Please have a representative call. ☐

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CITY_____ STATE_____

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You have got to *SEE* the outstanding new aluminum oxide M M Process Wheel in action to *BELIEVE* the amazing results it can accomplish for you, in grinding those "hard to grind" materials.

The self dressing qualities of this now famous M M Process are available to you in aluminum oxide abrasive. You too can now have the cost saving advantages of this cool cutting wheel.

Call your Macklin distributor today to arrange for a demonstration.

MACKLIN GRINDING WHEELS

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***Manufacturers of* GRINDING WHEELS AND OTHER ABRASIVE PRODUCTS**

JACKSON, MICHIGAN

There is a MACKLIN Field Engineer in your vicinity. MACKLIN distributors are located in all principal cities, with ample stocks to fill your needs.

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One Priceless Element In Every

POPE PRECISION SPINDLE

THE *Confidence* OF ITS USER

You can have complete *confidence* in the anti-friction bearings POPE puts into your spindles.

They are made to new super-precision tolerances.

You can depend upon Pope Spindles for the continuous production of accurate parts, fast removal of the surplus metal and fine *low* micro-inch surface finishes.

POPE Spindles have radial and axial rigidity capable of properly supporting modern cutting tools on high production work.

The shafts are large for extra rigidity and have enormous excess capacity.

With the POPE SYSTEM of Grease Lubrication used successfully for thirty-four years, there is no internal radial clearance for oil film in the bearings — none is required. Instead, the bearings are permanently internally preloaded for accurate centering and positioning of the shaft.

POPE leadership in spindle design and constant PROGRESS in engineering and manufacturing reduce your tolerances and production costs.

For trouble-free operation

YOU CAN SPECIFY POPE SPINDLES WITH *Confidence*

No. 103

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION

Established 1898

501 RIVER STREET • HAVERHILL, MASSACHUSETTS

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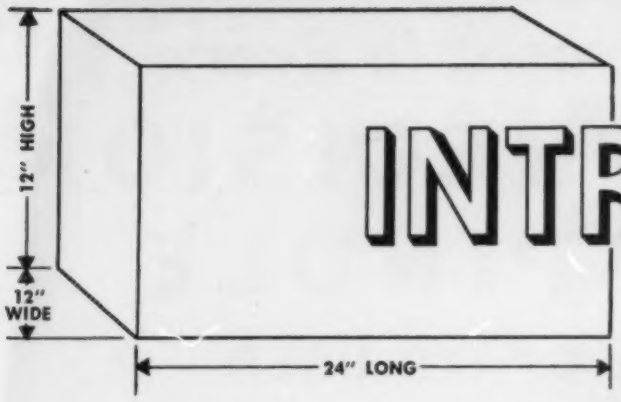
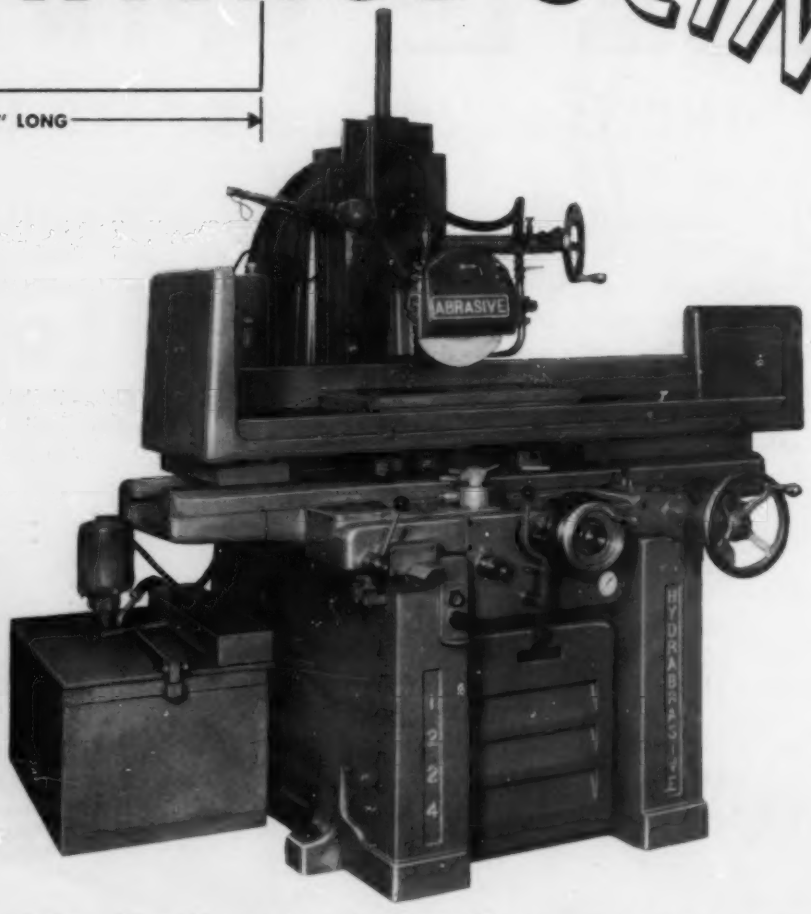


INTRODUCING...



Famous Hydrabrasive quality, accuracy, and performance in a new size . . . the **No. 1224** hydraulic-feed surface grinder.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE MACHINE TOOL CO.
36 Dunellen Road East Providence 14, R. I.

Send Bulletin 1224 describing new 12" x 24" x 12" Hydrabrasive Surface Grinder.

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Company.....

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Get Details, Today!

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PARKER - MAJESTIC pm PRECISION MACHINES

THE SEMI-AUTOMATIC INTERNAL GRINDER

Surprisingly Low in Cost with Greater Production

A new machine developed by the makers of fine precision grinders for over a quarter of a century.

AUTOMATIC SPINDLE IN-FEED—CAM-ACTUATED

Automatic sizing unit sufficiently versatile for production of one or many pieces. Accurately repeats on additional pieces after completing finished size set up on first piece. Available on either 12″ or 24″ table travel machines.

Table travel is accomplished by any one of three methods.

1. **HAND FEED**
2. **RECIPROCATOR**
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3 Reasons Why

Taft-Peirce Superpower Magnetic Chucks Save You Money

1 — You get the "right" chuck for every job. T-P offers you a complete line of *both* Electromagnetic and Permanent Magnet Chucks. A P-M Chuck has no wires to fail . . . no current to heat . . . it's the safest, most economical choice for many jobs. Ideal for grinding, light milling, planing, shaping, and bench work. Since we also make electromagnetic chucks, we'll be glad to advise you which is best for your job.

2 — T-P Cost-Cutting Designs. T-P offers you a selection of work-saving models — in practically all standard sizes and shapes. Maybe you need a T-P Superpower Chuck that tilts or swivels to save setup time. Or a fine mesh chuck to hold small or thin sections. Or a longitudinal pole chuck for greater versatility. Taft-Peirce makes them all and many more. Plus practically any special design you may need.

3 — Maximum Power and Performance. Taft-Peirce Superpower Magnetic Chucks combine maximum holding power with maximum working surface. Magnetic losses are low. Safety factors generous. Rugged, rigid, one-piece all-steel body is waterproof and shockproof. Little or no maintenance is ever required.

For information on Superpower Chucks and other items send for your copy of the Taft-Peirce Handbook.

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

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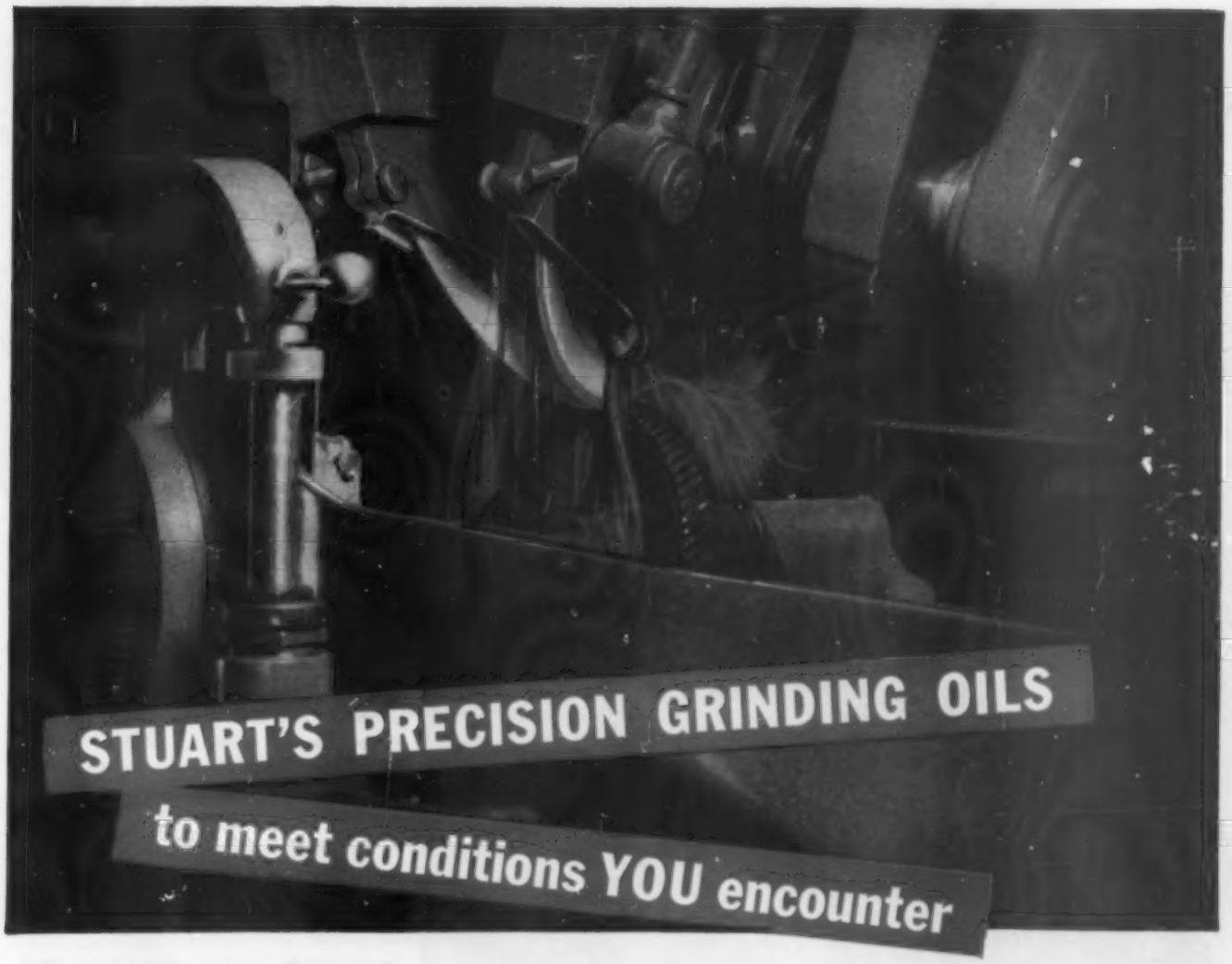

IF your grinding operation requires a straight oil there is a Stuart grinding oil that has been developed to meet the various conditions and problems *you* encounter. When using the *right* Stuart grinding oil for the job you can expect better wheel form and longer wheel life, better surface finish and closer tolerance control . . . all a necessity with today's demand for finer workmanship and engineering skill.

There are three types of grinding oils . . . hard, medium and soft. All are good on certain jobs but none are good for all jobs. "The Man in the Barrel," your Stuart Representative, will be happy to help select the proper grinding oil for your particular needs. Fill out the coupon below today . . . and be sure to ask to have "the Man in the Barrel" call.

HARD ACTING GRINDING OILS

. . . for grinding soft, tough, stringy materials such as stainless steels, monel metal and high temperature alloys. Also indicated where wheels of small diameter are employed such as internal grinding operations.

MEDIUM ACTING GRINDING OILS

. . . for use on the wide range of average work. They are fluids that have had both hard and soft acting qualities scientifically balanced to provide a very satisfactory performance, except under extreme conditions.

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. . . usually recommended when the work material is of high hardness. They possess high lubricity characteristics and are very effective where burnt work surfaces, or heat checking is encountered with harder acting oils.

More than a "Coolant" is Needed

D. A. Stuart Oil Co.
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In Canada: Canadian D. A. Stuart Oil Co., Ltd.
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CLIP TO YOUR COMPANY LETTERHEAD AND MAIL TO

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Supersheen
MODEL D-B 200
The Last Word in
ADVANCED BARREL
FINISHING
THIS ADVANCED DESIGN BARREL OFFERS THE UTMOST IN EASE, ECONOMY AND PRECISION IN DEBURRING AND FINISHING OPERATIONS
Supersheen
AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS

ALMCO SUPERSHEEN PROVED LOWEST COST METHOD OF DEBURRING AND FINISHING METAL PARTS

There is no lower-cost method of deburring and finishing metal parts. A single Almco Supersheen unit installation replaces from 2 to 12 men — with actual savings running as high as 95%. We know of no installation that HAS NOT paid for itself in less than a year. Many installations pay for themselves in only ONE OR TWO MONTHS. In 10 typical Supersheen operations finishing costs averaged 80.1% less than former methods — from 48% on a threaded cast iron pipe "T" to 95% savings on a small trigger with intricate configurations.

NEW USES IN ALL FIELDS

Almco Supersheen Engineers have developed new techniques that have greatly widened the scope of barrel finishing. Now, manufacturers in all fields are using the Almco Supersheen process to cover a wide range of finishing operations — deburring, grinding, cutting down, cleaning, forming uniform micro-exact radii, improving surface finish, reducing surface porosity, finishing threaded and intricate parts, removing paint, coloring, burnishing, etc.

Whatever the operation — the Supersheen process affords the quickest, best, lowest cost method to "A Better Finish Faster".

CONTROL PLUS VERSATILITY

Advanced barrel finishing is controllable to the highest degree. Results are consistently uniform and satisfactory. All operating conditions can be controlled, making it possible to produce almost any desired micro-inch reading — and to remove metal in nearly any quantity desired.

FREE SAMPLE PROCESSING

Almco maintains complete sample processing and research facilities. Sample processing is done FREE! We invite your samples and inquiry.

FREE!
This new booklet will open your eyes to ADVANCED Barrel Finishing! Write for BOOKLET.

MAIL COUPON NOW!

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ADDRESS _____

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Grinding Wheel News

A 75th Anniversary Announcement

WALTHAM has perfected VARIABLE DENSITY

As Grinding Wheels Wear Down

the constantly smaller diameter creates two changes in grinding action

- the surface feet per minute gradually become lower,
- the arc of contact between wheel and work gradually becomes smaller.

To Produce Uniform Grinding Action

Waltham has perfected Variable Density Grinding Wheels

from 16" through 36" as operations require

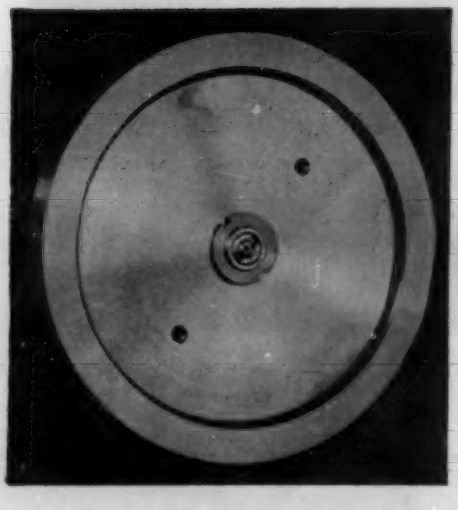
their density increases as wheels wear down— assuring uniform grinding action— a controlled grinding surface.

Typical User Reports

1. "The *grinding action* is the same *throughout* the *life* of the wheel. The important factor is that this cutting action was obtained *without* the aid of *increasing* the *speed* of the machine. We also increased the pieces per dressing. The over-all increase in production is about 25%. This wheel holds good corners and radius. Wheel is used for roughing and finishing."

2. "For the first time we are able to *grind*, successfully, the *face and side* of our work with the same *wheel*. Add this to the fact that the *cutting action* is *consistent throughout* the *life* of the wheel and results in an increase of about 15% in production."

Waltham Grinding Wheel Company · *1880-1955 Our 75th Anniversary* WALTHAM, MASSACHUSETTS



100% more pieces per grind
300% less tools required per job
400% savings in monthly tool cost

the superiority of ELOX electrical discharge grinding was proved by this large automotive company's unsolicited 2-month comparison report!**

Tool Name, Description:	Solid Carbide Insert	
Part Name:	Crankshaft	
Operation Name:	Finish Front & Rear Thrust Bearings	
	Standard Grind	Elox EDM Grind
TOTAL PIECES PER TOOL	17,290	95,904
MINUTES PER GRIND	21.0	13.75
COST PER GRIND	$ 1.26	$ .83
ESTIMATED MONTHLY TOOL COST	$294.71	$92.19

in writing **Elox will guarantee increased tool productivity over any type of abrasive grinding.**

Other Elox equipment available to remove broken taps, drills, etc., from $495 to $3450.

elox *corporation of michigan*

**Comprehensive report and company name given on request.
*T. M. Reg.

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the *Fluidmotion*® WHEEL DRESSER

furnished in an attractive carrying case for proper care.

forms wheels to shape easy as A B C . . .

on
- **Internal**
- **Cylindrical**
- **Surface Grinders**
- **Tool and Cutter Grinders**

This is the only Radii and Angle Wheel Dresser that will accomplish the form dressing of 2 angles, 2 radii and one flat tangent in one setting. It comes in several models to form dress wheels ranging from the smallest sizes to those of 24" in diameter.

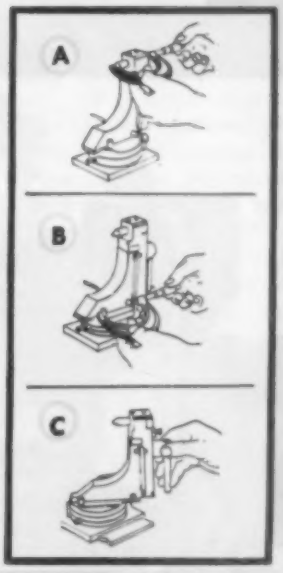
Fully adjustable, adaptable and semi-automatic in operation, the FLUIDMOTION Wheel Dresser is the only one requiring only a micrometer for setting to obtain any desired form.

Representatives in principal areas of the U.S.

A. Measure over diamond point to back of micrometer plate.

B. Add required convex radius or subtract required concave radius.

C. Tighten gib. Dresser ready for action.



J & S TOOL CO., Inc.

WHEEL DRESSERS J&S TOOL CO. INC. JAW CLAMPS • PRECISION VISES • HOLDING DEVICES **CLAMPCUT** • SINE BASES •

880 Dorsa Avenue **Livingston, New Jersey**

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Please send illustrated literature showing 6 models FLUIDMOTION Wheel Dresser and one model of Form Master with full specifications, operating instructions or special examples of time and money saving application

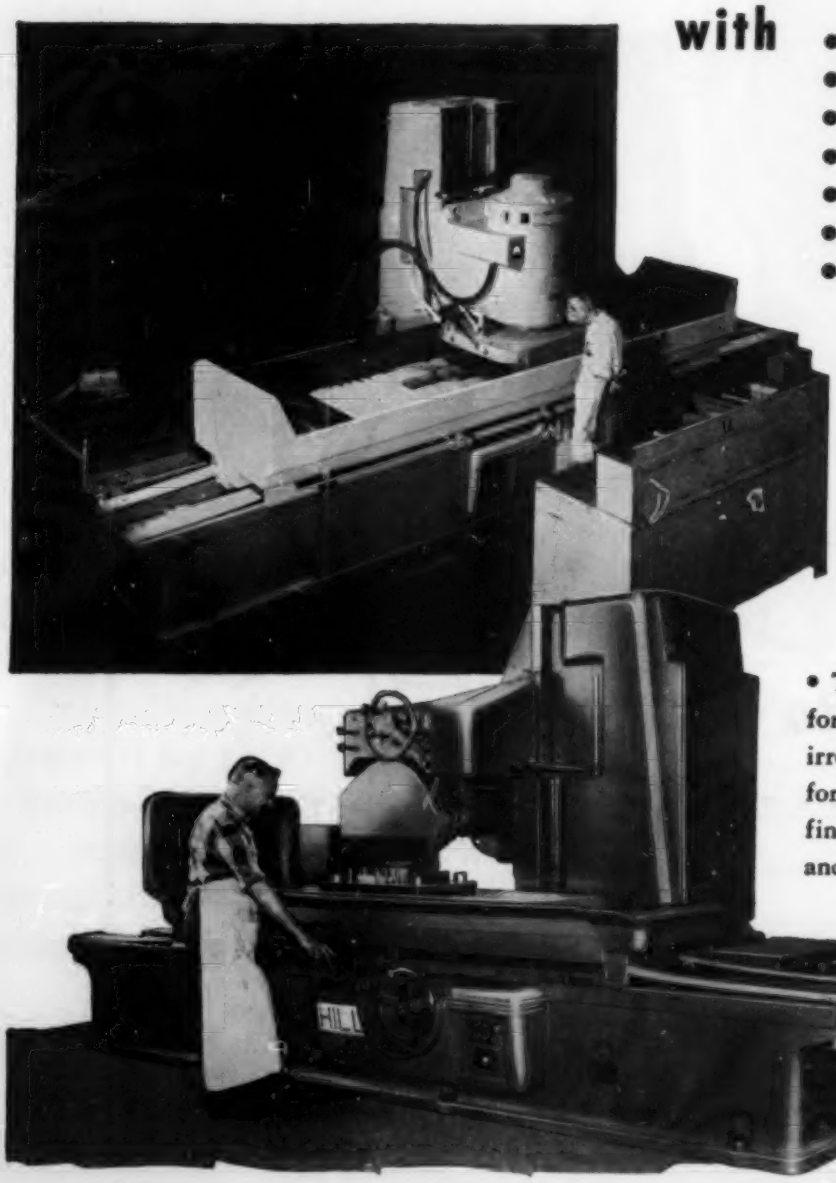
NAME..... TITLE.....

COMPANY .....

ADDRESS .....

HILL... THE SURFACE GRINDER WITH *all* THE WORTH-WHILE FEATURES

Two types, Horizontal Spindle or Vertical Spindle



with

- *Open Side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Assembly Controls*
- *Low Pressure Hydraulic System*
- *One Shot Lubrication*
- *Adequate Safety Devices*

• The "HILL" Vertical Spindle Grinder for rapid stock removal and accurate grinding of flat surfaces — recommended for accuracy, speed and finish — features that mean increased precision production. Made in table widths of 18", 24" and 30" with table lengths from 5 to 20 feet.

• The "HILL" Horizontal Spindle Grinder for a wide range of grinding — flats, angles, irregular and special shaped surfaces — ideal for maintaining close tolerances with superior finish. Made in table widths of 18", 24", 30" and 36" with table lengths from 5 to 20 feet.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

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"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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The Editor's Page

Our Responsibility

The success of any new magazine depends on joint efforts among publisher, advertiser and reader. In a sense we all have an investment in its success; certainly, we all have a professional responsibility—in varying degrees—toward one another. Without this sense of professional responsibility, bridges and buildings do not tower into the sky, factories do not hum and magazines are not born.

Our prime duty to you, our reader, is to present material you'll want to read. Industry's pace is swift. Progress is never an idle fellow. Yesterday's bright methods are today's dull tools. It is our aim to mirror our industry's growth, to measure its pace and to objectively report its technical progress. New tools, new cost cutting ideas, modern methods and, yes, at times a return for a fresh look at some old fundamentals—these we hope to present each month.

Our responsibility is not centered entirely on cutting costs and increasing production. We are vitally interested in industry problems. We believe in standards, not for a few, but for all products. Standards mean economy, efficiency, speed. Lack of them is a holdover from the free-for-all of the last century, resulting in higher costs for the user and unnecessary production delay.

Your safety is also of deep concern to us. We believe wheels and machines are as safe, if not safer, than automobiles, and accidents occur when someone forgets, or thinks he knows more than the manufacturer. No man is above safety! No man is bigger than safe practice!

Young men must be attracted to our industry. We need electrochemists, ceramic engineers and mechanical engineers. At the same time that we exhort young men to join our ranks we will prod industry to make it worth their while financially to do so.

It must be our responsibility to be objective and impartial at all times, and be brave enough to resist those wicked currents which constantly whirl an editor between the Scylla of publicity boiler-plate and the Charybdis of advertisers' pressure.

Yet, though mindful of our responsibilities, we are also conscious of our human frailties. We are not as wise as you, our reader, nor as positive as our advertisers; we hope to learn from both. And so with your wisdom, the advertisers' positiveness and our own sense of responsibility, we hope we may all become good friends and enjoy a jolly and profitable association.

William F. Schleicher

How Grinding Standards are Established With Standard Data . . . Part 1

By **E. A. Cyrol,** president,
E. A. Cyrol, & Co.,
Management Consultants,
Chicago, Ill.

What Standard Data Will Do For You

- ✓ **provide good production standards**
- ✓ **eliminate misunderstanding between management and union**
- ✓ **establish standards on short-run production**
- ✓ **eventually ease lengthy time studies**
- ✓ **increase effectiveness of wage incentive programs**

This is the first of a series of articles by E. A. Cyrol. This article explains how standard data for external plunge grinding can be established.

Mr. Cyrol has been cited by the University of Michigan for distinguished contribution in the field of engineering. He is a director, Federal Tool Corp., Chicago; director, Industrial Management Society; and is listed in Who's Who in the Midwest, Who's Who in Business and Industry, and Who's Who in Arbitration.

● THE DEVELOPMENT of a production standard for industrial operations is still a matter of controversy in many of its aspects. However, it is the intention of this article to serve solely as bench marks in similar grinding elements.

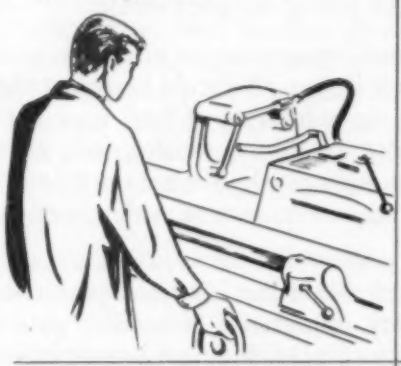
The attempt is made here to outline the method of data organization. The data is presented in logical steps from original studies, posting to spread sheets, analysis for constant and variable relationships and recombining these in a form that can be readily used.

Standard Data—What Is It?

Definitions of standard data do not apply universally. When standard data is mentioned in conversation even among industrial engineers, it is not always clear to the listener just exactly what the speaker means by the words **standard data.**

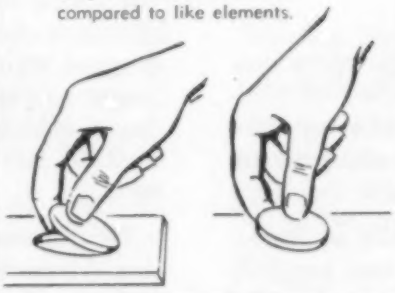
Three different treatments of time values for factory operations are indiscriminately called standard data.

(1) The Operation



(2) Element Description

Watch Reading Points.
Only like elements can be compared to like elements.

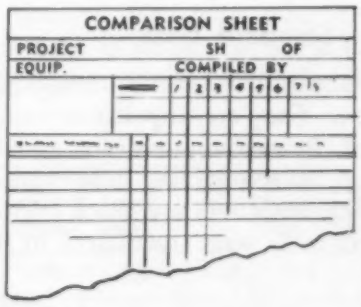


(3) The Timestudy

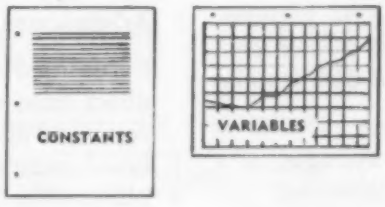
Element Time
Actual time x rating.

Note Waste motions and Work conditions.

(4) The Spread Sheet



(5) Analyzing for the time values

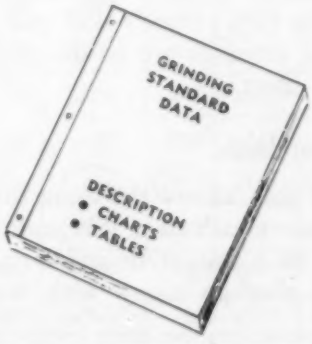


(6) The Check Studies

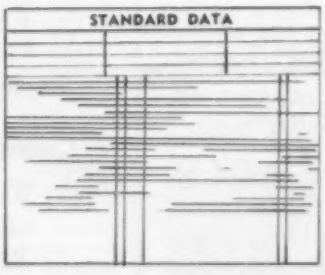
Actual time x rating.
Per Cent Variation from the Standard Data developed.

High Production Jobs 5%
Job Shop Operations 10%
Indirect .....15% - 20%

(7) The Write-Up



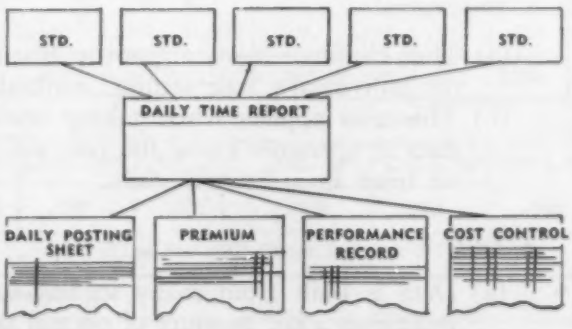
(8) Work Data Sheet



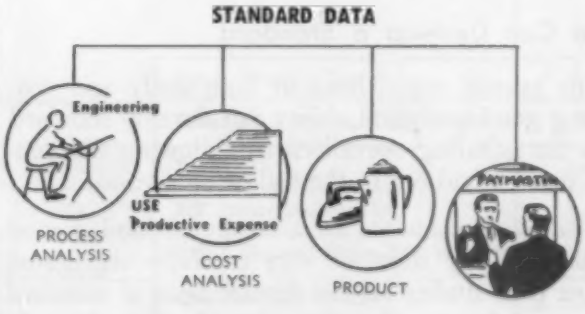
(9) The Explanation to:

a. The Standards Setter.
b. The Foremen.
c. The Workmen.

(10) Results & Controls Standards on specific jobs.



Product Cost Estimating:



First, we have the approach of applying time values to therbligs or similar fundamental motions. Examples of this approach are Work Factor, MTM, RCA's and A.B. Segur's time values.

Second, there is the approach wherein several time studies of the same operation are made; the elements are compared; and the elemental time values are selected according to the industrial engineer's judgement. These values are then called standard data.

Third, time studies are made of similar operations. If a class of grinding operations is studied, all identical elements whether constant or variable are compared one to the other and elemental standards are established that are called standard data.

These elements are actually a family of fundamental motions, and they must be very carefully segregated before time studies for the development of standard data are taken so that time values from each study can be compared to those of every other. This can easily be done by establishing an elemental breakdown pattern, as shown in the Detail Elemental Description, after several exploratory studies have been taken in the plant where standard data is to be developed.

Each of these elements have been averaged or a graph drawn of the basic variable relationship.

The Work Sheet has been developed for the External Plunge grind in a production shop handling small and flexible or thin wall sections. Here is a set of bench marks which can be used as a guide under similar or comparable operations.

The condition and type of equipment, the width and type of grinding wheels, the material and the material handling methods all have an influence on the correct elemental values for a particular plant.

Before using the data carte blanche, it should be thoroughly checked particularly toward the extremes and the area where the majority of work in the plant falls. Although the detail descriptions of the elemental values and the area of application will accompany subsequent data, the stress in this article will be on "How to build up standard data in a plant."

Who Can Develop a Standard

Any person experienced in time study and possessing good analytical ability can develop standard data for grinding operations by following the general pattern laid out in the following sections.

The actual elements are a family of fundamental motions. They must be very carefully segregated before time studies for the development of standard data are taken so that the values from each study can be compared to those of every other study.

This can easily be done by establishing an elemental breakdown pattern after several exploratory studies have been taken in the plant where standard data is to be developed.

However, there are pitfalls in establishing the data. Care must be taken in the breakdown of basic variables so that possible application to a future type of product will not give a distorted result.

In a shop handling a variety of materials, it would be wise to check if they all should be run at the 100 sfm and with the same rate of feed used here. If frequent separate rough and finish grinds are used, they should be segregated. Tolerances below .001″ or .0005″ may require more time with certain equipment.

The consistent use of the same end points for the elements is very important. Naturally, good time study practice, such as excluding all extraneous time and noting it for possible use in establishing allowances, should be observed at all times.

Advantages of Standard Data

Recorded standards have many advantages over direct time study. They are impersonal—more correct—and ageless. In addition they offer a sound and broad foundation for recognizing individual accomplishments. These objectives are aided by standard data when used with wage incentives in at least five ways.

1. Considerably Less Expensive.

(a) Economical to measure individual output.
(b) Recognizes each person's skill and ability.
(c) Individual earnings are in direct relation to skill and effort.

2. Consistent Standards.

(a) Recorded data allows the same time for the same element each time it repeats.
(b) Reduces to a minimum industrial relations problems that go along with wage incentives.
(c) Revisions are easier to make.

3. Impersonal.

(a) They eliminate many arguments that exist in the individual's "rate setting" method.
(b) This also applies when taking studies for data as operators know the rate will not be set from an individual study.

4. Fair.

(a) Data is built from many studies and thus represents a fair measure of normal skill and effort.

(b) Because the same time is allowed each time the element repeats the measure of normal continues. Differences in output are fairly measured and rewarded.

5. Predetermination of Labor Costs.

(a) Management determines the best method.
(b) Management can determine the labor cost on new or proposed product changes before the decision to change is made.
(c) This makes for lower cost, better deliveries, correct pricing, and application of standards to both direct and indirect labor operations.
(d) Higher productivity from correctly measured work.

These studies cover the following types of external grinders, center type: Norton 6x18; Landis 4 h plain; Brown & Sharpe No. 20; Brown & Sharpe No. 5; Brown & Sharpe No. 2; and Cincinnati No. 3.

Detail Elemental Description

The detailed description which is included with each element is important for making the proper analysis of the results on the Spread Sheet and to enable others to properly apply the element in developing standards in the future.

Due to the complexity and number of values on the Work Sheet some of the miscellaneous elements which occur only occasionally were not included, but are listed below. From time to time it may be necessary to use additional elements. These should be time studied, recorded, and after sufficient study, included in the data.

Grinding Standard Data Elemental Description

1. Grinding Time (see table on Work Sheet)

This element includes the time from the first heavy spark or putting the machine on automatic feed until the in-feed is stopped. (A work speed of 100 surface feet per minute was used.)

2. Lap Time (see table on Work Sheet)

This element includes the time from the finish of the in-feed until the spark out is completed.

3. Piece Handling Time **.197 minutes**

(a) **Assemble Dog on Piece.** Obtain piece from skid, pick up dog and wrench, assemble dog

GRINDING STANDARD DATA WORK SHEET (EXTERNAL PLUNGE GRIND)

Diameter Over	Diameter Thru	Time per .001 Stock	Lap Time	Piece Handl. Time	Mach. Time Auto	Mach. Time Hand	Wheel Dress
0	.250	.012	.040	.197	.198	.281	.030
.250	.550	.015	.070	.197	.198	.281	.061
.550	.850	.019	.100	.197	.198	.281	.071
.850	1.150	.022	.130	.197	.198	.281	.076
1.150	1.450	.026	.160	.197	.198	.281	.087
1.450	1.700	.029	.185	.197	.198	.281	.095
1.700	2.000	.032	.215	.197	.198	.281	.109
2.000	2.300	.036	.245	.197	.198	.281	.122
2.300	2.600	.040	.275	.197	.198	.281	.138
2.600	2.900	.043	.305	.197	.198	.281	.152
2.900	3.200	.047	.335	.197	.198	.281	.169
3.200	3.500	.050	.365	.197	.198	.281	.190
3.500	3.800	.054	.395	.197	.198	.281	.202
3.800	4.100	.058	.425	.197	.198	.281	.217
4.100	4.400	.061	.455	.197	.198	.281	.234

Width of Shoulder						
0-.250	.251-.375	.376-.500	.501-.625	.626-.750	.751-.875	.876-1.000
.014	.030	.034	.040	.044	.048	.052

Time Per .001 Stock Removed Off Shoulder

Date Entered

Computed By Approved By

Date	FEB. 16, 1955	Part Number 8734
Part Name	SHAFT	Operation Number 70
Type Machine	BROWN + SHARPE	Machine Number
Arbor Number		Gage Number
Dept. No. 40	Dia. of Piece 2.23	R.P.M. 165
Disc. of Oper.	GRIND 2.230 $^{.000}_{-.002}$	
Grinding Wheel No.	5A 80L -12- V20	

Time Per .001 Stock	.036	
No. of .001's Stock Removed	x 12	
Grinding Time	.432	.432
Lap Time		.245
Piece Handling Time		
Machine Handling Time		.198
Arbor Unloading and Loading Time		
Wheel Dress Allowance for Dia. Grind.		.122
Wheel Dress Allowance for Shoulder Grd.		
Shoulder Grind Time		
Position Wheel to Shoulder	.045	.045
Check Length Before Grind	.120	
Check Length After Grind	.100	

Total Minutes Per Piece	1.042
Personal & Unavoidable 11.1%	.116
Total	1.158
20% Incentive Factor	.232
Total Allowed Mins. Per Piece	1.390
Hrs. Per 100 Pieces	2.32
Pieces Per Hr.	43.1

on piece, tighten with wrench and aside wrench.

(b) **Remove Dog.** Pick up wrench, loosen and remove dog, aside piece to skid. **.064 minutes**

(c) **Gauging Time—O.D. on Sheffield.** Position piece on Sheffield gauge, approximately 18 inches, and check size. **.070 minutes**

(The total Piece Handling Time is used only when grinding a plain or straight diameter and is usually performed while the piece is lapping out in the machine. See Work Sheet explanation.)

4. Machine Handling Elements for Automatic Machines .198 minutes

Pick up and seat piece between centers (from table approximately 18″)	.069
Position wheel to grind	.036
Retract wheel	.030
Remove and aside piece from center to table	.063

(These times pertain to grinding plain diameters)

5. Machine Handling Elements for Hand-Operated Machines .281 minutes

Pick up and seat piece between centers (from table approximately 18″)	.069
Position wheel to grind (with handwheel)	.036
Start work head (by moving lever up)	.020
Start coolant (by lever)	.021
Retract wheel (using handwheel)	.030
Stop coolant (by lever)	.022
Stop work head (by moving lever down)	.020
Remove and aside piece center to table	.063

6. Wheel Dress Time (see table on Work Sheet)

This elemental time has been computed by dividing the average wheel dressing time of 3.04 minutes by the average number of pieces per dressing for that diameter. (The second article of this series will cover wheel dressing time for hardened steel parts.)

7. Position Wheel - Shoulder & Diameter .085 minutes

This element includes the time allowed for the operator to position wheel to shoulder and diameter that is being ground.

8. Position Wheel - Shoulder .045 minutes

This element includes the time allowed for the operator to position wheel to shoulder that is being ground. (This element allowed only when grinding shoulder.)

9. Gauging Time - Shoulder on Surface Gauge Before Grind .120 minutes

This element includes the time for the operator to position piece to surface plate, and with surface gauge check length to be ground, to find amount of stock to be removed. (This element is allowed when grinding a shoulder to a given length of dimension, and no arbor or fixture is available for the operation, which makes it necessary to check before grind.)

10. Gauging Time - Shoulder on Surface Gauge After Grind .100 minutes

This element includes the time for the operator to position piece on a surface plate and with a surface gauge check the length ground. (This element is allowed when grinding a length or shoulder to a given dimension.)

11. Pick Up and Aside Piece .055 minutes

This element includes time allowed for the operator to pick up piece and aside piece from centers to table 18″.

12. Position Piece On and Off Centers .077 Minutes

This element includes time for the operator to position on centers, and remove piece from centers.

How to Use Work Sheet

A production standard is calculated on the Standard Data Work Sheet. This example is intended to serve as a guide for building up a standard through the use of data.

The Standard Data Work Sheet must be carefully filled out with all pertinent information regarding the operation. After the production standard has been calculated and transferred to the shop's routing and payroll records, the Work Sheet should be filed for future reference. Should a standard be challenged, the Work Sheet and all its information, including description and calculations, will be the basis of any investigation.

1. Fill out right side of Work Sheet with date, part number, operation number, part name, type machine, machine number, arbor number, gauge number, department number, diameter of piece, rpm, setting of work speed, grade wheel, description of operation.

2. From the Operation Sheet or blueprint get size of part being ground. On the chart on the left side find this size. The figure in the column on the right will give the allowed time to remove .001 stock. Put the figure in the space for time per .001 stock.

3. From the Operation Sheet find the size left by the preceding operation. Then subtract the size ground from size before grinding to find the amount of stock to remove. Put the number of .001's in space for the number of .001's stock removed.

4. Multiply number of .001's stock by time allowed per .001 to obtain the allowed grinding time. Put that time in the space to right.

5. If machine is hand operated use the column headed Machine Handling Time Hand Operated. Put the constant of .281 in the space labeled Machine Handling Time. If machine is automatic type use the time of .198 in the space for Machine Handling Time.

6. On an automatic machine when the total of the lapping plus grinding time does not exceed the Piece Handling Time of .197, use the .197 Piece Handling Time. On a hand type machine use the lap time when it exceeds Piece Handling Time.

7. Use the wheel dressing time for the diameter being ground.

8. When grinding a diameter with a shoulder or radius, but no definite size to hold, use the Position Wheel to Shoulder time of .045 minutes.

9. When grinding a diameter with a shoulder with a definite size to hold, and no arbor is available, add the time of gauging shoulder before grind of .120 and gauging after grind of .100.

10. When grinding a diameter with a shoulder with a definite size and an arbor is available, add only the gauging after grind—.100 minutes.

11. Add the extensions in the right hand column to determine the total minutes per piece.

12. Add 11.1% for personal and unavoidable delay allowances. (These should be determined for each group of equipment.)

13. To the resulting total, a 20% incentive factor is added for the bonus potential for an operator achieving the expected output. If no incentive is used the 20% can be considered as an adjustment factor to have the standard reflect the amount of work that can be expected under daywork conditions.

14. Finish the computation for total minutes per piece, hours per hundred pieces, and pieces per hour. (Under incentive conditions, it is anticipated that the operator will produce 20% more than this.)

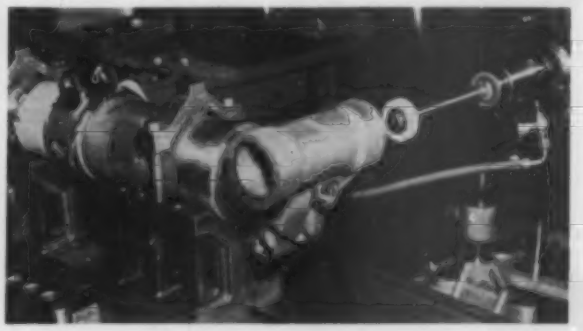
● ●

Carbide Tool Life Increased 320%

A single point carbide tool for screw machines formerly producing a maximum of 25,000 cold rolled steel pinion shaft parts now delivers over 80,000 pieces before resharpening. This increase was achieved by subjecting the tool to a quick Vapor Blasting treatment, a "Liquid Honing" process which improves cutting tool life.

The tool is used on an automatic screw machine operation at a large Toronto, Canada plant. The tool, as previously used, sharpened by "green grit," and diamond-wheel finishing, showed a saw tooth roughness and prominent grind lines under magnification which caused numerous rejects, and at best produced parts with from 50 to 70 microinch finish. After treatment by Vapor Blasting with 1250-mesh abrasive, the edges were smooth, grind lines blended out, and each tool was capable of producing a finish of from 25 to 30 microinch. The tool has produced 80,000 parts and is still going strong. It was noted that the tool actually improved after cutting the first several thousand pieces, working in cold rolled steel. The equipment is made by Vapor Blast Mfg. Company, 3033 West Atkinson Ave., Milwaukee 16, Wisconsin.

Photo shows the edges of the same tool magnified 125 times. Top, tool sharpened in usual way indicates a "saw-tooth" edge and obvious grind lines—good for 25,000 pieces—with numerous rejects. Lower portion, Vapor Blasted, shows smoother cutting edge, blended grind lines.



A Vulcanaire Jig Grinder was used to grind a 2½" diameter hole 5¼" deep. However, because the hole finish was important, the inspection department would scrap all castings showing reamer marks. The casting itself was approximately 5 feet long with the hole on an angle with the body, making it almost impossible to grind on an internal grinder.

The problem was overcome by using V-blocks with a sine part to locate the part. The Vulcanaire mounted in a horizontal mill was then able to grind the part without rejections.

The jig grinder is made by Vulcan Tool Co,. Dayton, O.

Our problem:

Grind 480 gear teeth on 20 gear hubs

Hold to extreme accuracy

Provide a 4-6 micro finish

How we solved it:

Crush Dressing and Grinding on a Surface Grinder

By **Paul Prikos,** Vice President
Prikos & Becker Tool Co.
Skokie, Illinois

What we learned:

- ✓ crush wheel in at full width of wheel form . . . avoid crushing on half of wheel only
- ✓ used steady stream of coolant to keep wheel clean
- ✓ center of wheel must be centered with center of crusher axle
- ✓ spindle should have no play
- ✓ wheel should not have babbit
- ✓ if grinder wheel is going clockwise, crush roller should be counter-clockwise

● OUR PROBLEM was basically this: Grind the gear teeth identical to the tolerances as shown in figure 1. These 20 gear hubs with 480 gear teeth were used in a plastic mold and had to be held extremely accurate with a 4 - 6 micro finish.

We knew that any attempt to dress a grinding wheel with a conventional precision radius dresser would prove inaccurate. The repeated settings of redressing the wheel over and over again could not be duplicated; furthermore, we preferred not to tie up a radius dresser on one job, when it could be used on other jobs.

Frankly, until three months ago, our only association with crush grinding was what we had heard or what we had read in theory. Like so many other people we knew about crush grinding in vague generalities, but when it came down to facts, our knowledge did not come from actual experience. Consequently we went through the experience of crush grinding by a series of costly, and at times, discouraging events, until rewarded by final success.

After a decision had been reached to crush grind we asked experts in the field, who were doing a form of crush grinding in their shops, to share with us some of their basic know-how. Here is some of the information we gained.

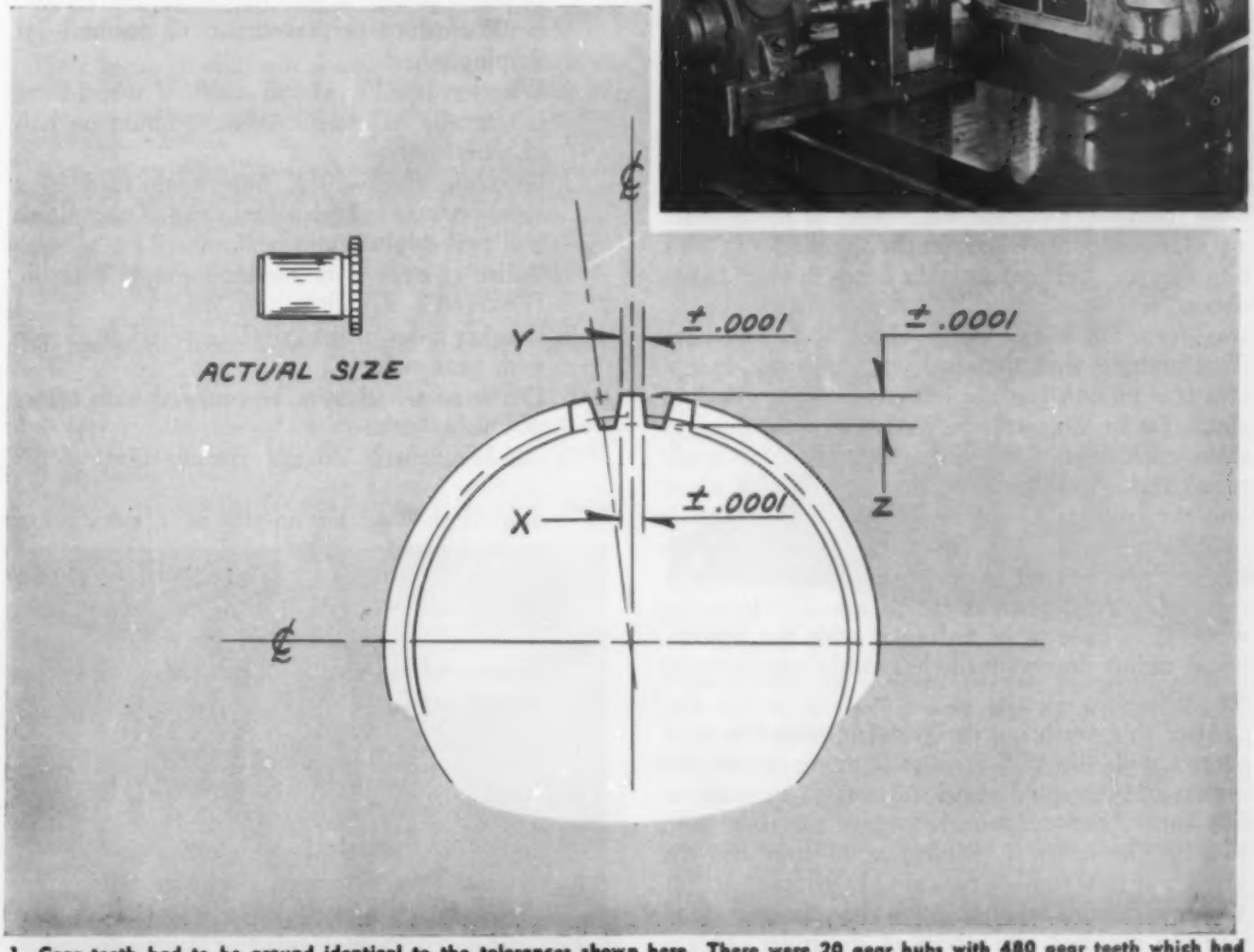
1. Never crush grind with grinding oils or solvents —only dry. Reason: Actual experience on other jobs proved so.
2. From another source: only crush grind with oil. Reason: To remove the loose abrasive.
3. Use a high speed steel roller with slots cut laterally, to allow loose abrasives to run off the roller. See figure 2.
4. Never let the roller rotate on a spindle that has tight fitting bearings. Reason: It will tend to freeze when the wheel is pressed against the roller form. The give is downward, hence the form will be accurately reproduced.
5. You cannot crush grind within a closer tolerance than .0005" limits.
6. You can crush grind within .0005", but you must redress often.

Naturally we were perplexed, and like many of us have discovered, the only solution was to dig in and overcome the problem.

2. Two views of the grinding set-up. Notice the "U" shaped fixture made of CRS plate, square up, and a hole bored in line to receive the roller shaft. On one end of the fixture is mounted a gear reducer, rotating at 76 rpm and connected to the shaft by means of a coupling.

Details of the grinding set-up

To analyze the set-up for this type of grinding observe figure 2. Notice a style "U" shaped fixture.



1. Gear teeth had to be ground identical to the tolerances shown here. There were 20 gear hubs with 480 gear teeth which had to be held to a 4-6 micro finish.

It is made of C R S plate, squared up,and a hole bored in line to receive the roller shaft. On one end of the fixture is mounted a gear reducer, rotating at 76 rpm, connected to the shaft by means of a coupling. This shaft rotates in bronze bushings, close fitting. The roller is H S S, hardened to a Rockwell C-60. It is further nested between the C R S plate with felt washers that prevent endplay, and prevent dirt from getting into the bearings. Besides making certain that the fixture is sturdily built and accurately made, we must make sure it is properly mounted on the magnetic chuck of our surface grinder. It is advisable to mount the unit on the chuck with clamps, and not to rely on the magnetism of the chuck, for the obvious reason that the magnetic chuck must be released every time we load and unload a piece part. If our dressing unit is not properly anchored, the repeated set-ups will be off and inaccuracies will ensue. Lastly, in such a precision job, the chuck is skim ground square with the grinding wheel previous to starting the set-up.

Before going into the further analysis of what made this grinding successful, it may be best to explain the simple motions behind the theory and actuality of crush dressing and grinding.

The theory of crush dressing and grinding

Let us presume the set-up on the surface grinder is as shown in figure 2. Now let us mount a grinding wheel in the spindle of our grinder. At this point we do not have an accurate form in our roller and the grinding wheel is brand new, (out of storage —no form). We engage the switch of the grinder after mounting the wheel, let the spindle warm up a bit (standard practice) and take a conventional radius dresser, set the diamond, and properly dress the desired form into the grinding wheel. So far, we have done nothing with the crush grinding unit, except that it is mounted at the left edge of our grinding chuck (as in the picture). We now take a piece of shim stock or thin bakelite (mounted on an angle plate) and grind the newly dressed grinding wheel into the bakelite to reproduce our profile. This is used for measuring. We set-up the bakelite part in the comparator and inspect it, to make certain it conforms to the print requirements. The grinding wheel may have to be redressed with the conventional radius dresser until the profile requirements are satisfied.

After this, we bring the grinding wheel in close contact with the H S S roller, making certain the centers of both spindle and roller shaft are right in line (one above the other). Engage the roller unit switch. The roller is rotating at 76 rpm and the grinder at 1700 rpm—a typical O D grinding set-up. We now carefully plunge down the grinding wheel into the roughed out groove of the roller. This is done at the rate of .0002" per revolution of the roller. Several wheel dressings with the radius dresser are required in this initial process until at last the form is completely grooved into the roller. Then turn off the roller switch.

Now we have a form in the roller, duplicate to the form on the grinding wheel. Turn on the grinding wheel switch, ready for the piece part. Set up the piece part in line with the wheel and start regular grinding. After many passes we come close to our size. Then, checking with our instruments, pins, micrometers, comparators, etc. we find the grinding wheel size has worn off. Shut off the spindle of the grinder so that the wheel is motionless. Turn on the crush roller and contact the grinding wheel, and be sure both are in vertical alignment. Force the wheel into the roller (this will make the grinding wheel rotate) .0002" per revolution for about .002" removal (approximate required to correct size). Return to our grinding position. Turn off the crusher, engage the grinding wheel spindle switch, and proceed to regrind the piece parts. Continue the procedure until the job is done.

Our actual findings in successfully completing the job as stated in the beginning paragraph and figure 1. are as follows:

1. Depth of plunge of grinding wheel into crusher is .0002" deep per revolution of crusher—for shaping wheel.
2. Wheel crushed in at full width of wheel form is centrally balanced. Avoid crushing on half of wheel only.
3. Grinding fluid—201X Superkool—used in a steady stream to keep wheel clean. Other fluids will probably work as well.
4. Roller grooves to be made: 1 rough, 1 finish. (Difference of approx. 005").
5. Crusher roller drives grinding wheel at 76 rpm with gear reducer.
6. Center of wheel must be centered with center of crusher axle.
7. Crusher wheels do not require slots as per picture.
8. Spindle should have no play in it, sideways or up and down.
9. Wheel should not have babbit. Bushing hole should be cut in wheel to fit on adapter snug, so there is no movement of wheel, up or down, when crushing. Again, this pertains to extreme accuracy only.
10. Wheels used were: 7" x ¼" x 2" Hole A180-09V.
11. Crusher roller should be H S steel, hardened and no lateral grooves. (Others use cast iron, we preferred H S S).
12. If grinder wheel is going clockwise, crush roller should be counter-clockwise.
13. Only 7 redressings with the roller required to complete our job.

We reached several other conclusions relative to crush grinding; however, these were not proven:

1. No need to have lateral slots for dirt and abrasive removal as our roller had. This tends to make a hardship on the machine spindle. You can feel it bump everytime a slot hits the grinding wheel.

2. Use a rugged grinder with a free rotating spindle.

3. Use a double roller setup—in line—one for roughing, one for finishing. (We used one roller with a finishing and roughing groove, 1" apart.)

4. Crush grinding can be done dry when wheel form is wider and more substantial.

5. For a job lot the crush method is economical and repeated accuracy is assured.

If anyone has any evidence along these lines not only we, but we feel sure other readers of GRINDING and FINISHING would like to hear about it.

One last mention on crush grinding to great precision is that we had to maintain a constant temperature of 70°. We discovered that while the spindle of the grinding machine would reach its required warmth after 30 minutes, the complete frame of the grinder and roller crushing fixture took as long as 4 hours to heat up uniformly. We noticed changes up to .0005" and .001" during the beginning four-hour period. After that we could grind to the plus or minus .0001" limits. Although we set the night and day heating temperature the same, we discovered that the actual running of the grinder and crushing unit would set-up its own thermal changes. ● ●

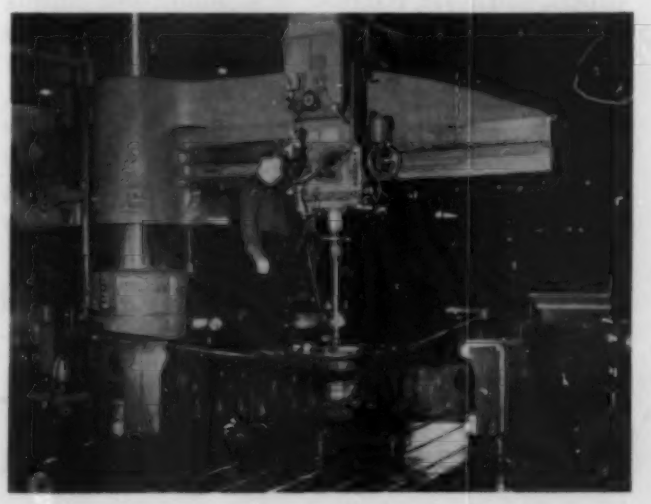
A Radial Drill Honing Attachment

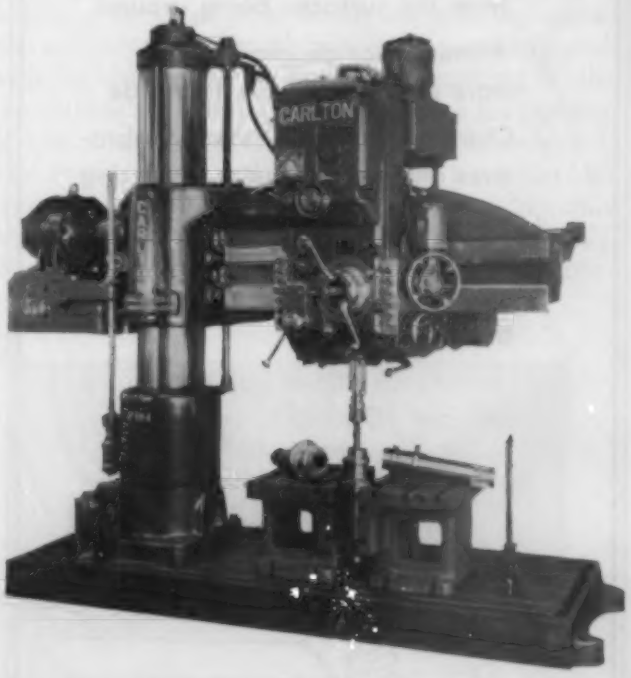
This SA radial drill with honing attachment is installed in the East Pittsburgh works of Westinghouse Electric Corp., and is used for honing operations as well as for conventional drilling.

The honing operations involve drill jigs, miscellaneous items and spiders. Holes from 2 in. to 5 in. in diameter have been worked, although smaller and larger holes can very well be handled. The unit will hone blind or through holes and has a 5 in. minimum and 24 in. maximum stroke. Although Westinghouse requirements call for only a 12 to 15 microinch finish, it is possible with the radial drill and honing attachment to get the finish to within 1 microinch.

Tolerances on diameters are held to within .0002 in. This has improved the quality, and as a result of making holes more uniform in size, has resulted in a cost saving for Westinghouse.

The coolant for the hone is housed in a special tank separate from the lubricant used for conventional drilling, and one set of stones usually lasts for the complete job, or an average of 12 holes.





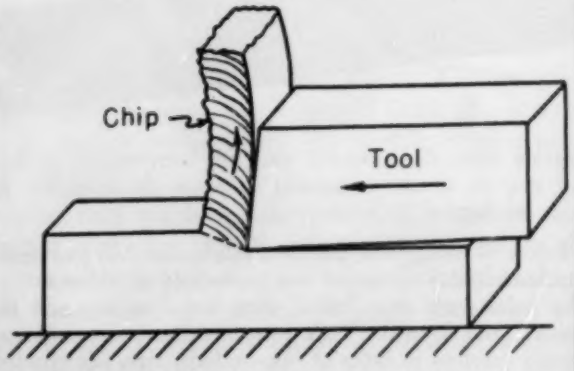
Before Westinghouse installed this radial drill and honing attachment, this operation was performed as follows:
The holes were first drilled, then bored to size and then reamed and lapped. This was a delicate operation and usually resulted in holes of non-uniform size. To eliminate this condition, the largest hole was lapped and the rest of the holes were lapped so that they conformed to that size.

The radial drill and honing attachment are made by the Carlton Machine Tool Co., Cincinnati 25, Ohio.

A Modern Perspective of the Grinding Process

By **H. R. Letner,*** Senior Fellow
Mellon Institute of Industrial Research
Pittsburgh, Pa.

- ✓ Abrasive grains act like the tool bits in milling machines and lathes
- ✓ Abrasives remove distinct chips from the surfaces being ground
- ✓ Aluminum oxide grains crush more easily than silicon carbide
- ✓ Chemical reaction between abrasives and work a factor in glazing
- ✓ Boron carbide and silicon carbide, harder than aluminum oxide, dull more rapidly on steel than does aluminum oxide
- ✓ Endurance limit of ball bearings is reduced 20 or 25% by severe grinding



1. Orthogonal cutting.

ONE CHARACTERISTIC of the grinding process upon which there seems to be general agreement is that the abrasive removes discrete particles or chips from the surface being ground.

There is less agreement concerning the nature of polishing. One view holds that it is a continuation of the grinding process on an extremely small scale. Electron micrographs show that the dimensions of polishing powders extend down to the microinch range and that chips which are formed are even smaller than the particles producing them. Another view holds that polishing is primarily a process of plastic flow of the surface material which results in the formation of an amorphous layer. There is electron diffraction evidence for this behavior.

These views are not necessarily irreconcilable. It can be demonstrated that the surface of glass, plastic or metal flows during grinding and that the amount of flow depends upon the grinding conditions. Since chips unquestionably are formed in this process, it is not inconceivable that polishing is also a process of simultaneous chip formation and plastic flow. Chemical reaction, which appears to be a factor in grinding, may be even more important in polishing.

Theories

Abrasive articles, such as wheels, stones, belts and papers, often are referred to as multipoint cutting tools. There is a great deal of evidence that, on a microscopic scale, abrasive grains act much like the tool bits in milling machines and lathes. There is, of course, at least one very important difference. The geometry of tool bits is comparatively simple and is controlled closely to give the desired cutting effect, whereas the geometry of abrasive grains is extremely random.

The mechanics of chip removal has been worked out for cutting tools of simple geometry and the re-

*A contribution from the L. Leslie Byers Memorial Fellowship sustained at Mellon Institute by the Grinding Wheel Institute and the Abrasive Grain Association.

sults are of considerable theoretical interest in connection with the action of abrasives. In particular, the orthogonal cutting of metal has received a great deal of attention because the mechanics involved can be represented on a two-dimensional diagram. In orthogonal cutting, a straight-edged cutting tool moves relative to the workpiece in a direction perpendicular to its cutting edge, figure 1. Actual chip removal by such a tool is shown in figure 2.

The geometric randomness of abrasive grains leads to a more complicated process; nevertheless, there are certain features of grinding and orthogonal cutting which are basically the same. Figure 3 is a photomicrograph showing chip formation by an abrasive grain.

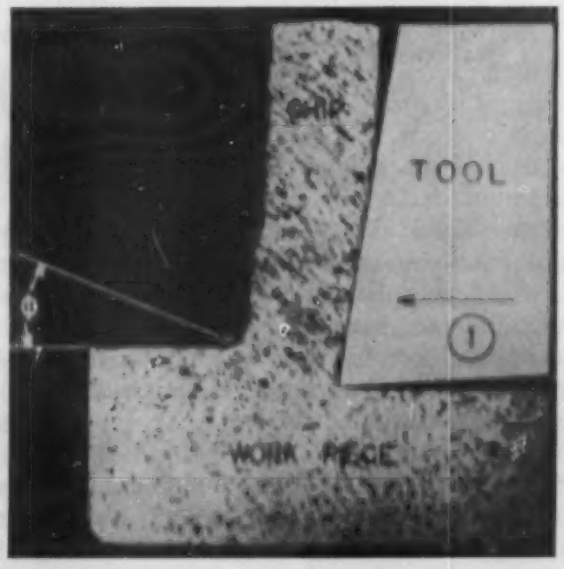
Takeyama applied the theory based upon orthogonal cutting to the grinding of steel with 60-, 100-, 240-, and 400-grit aluminum oxide abrasive belts. Briefly, he found that the work per unit volume of metal removed, calculated from the theory, is less than one-sixth of that measured experimentally. The difference, he explains, is due to the following causes:

In orthogonal cutting, for which the theory was developed and for which it works quite well, all the metal which lies in the path of the tool is removed in the chip. In cutting with abrasive grains, this is not the case and the difference is illustrated in figure 4. Only that part of the metal in the path of a grain which is most highly stressed is removed in the form of a chip; the rest is plastically deformed and remains a part of the surface. A portion of the latter will be removed by another grain and the remainder again will be plastically deformed. The energy required for this succession of plastic deformations, which is not considered in the theory for orthogonal cutting, undoubtedly represents a part of the difference between the calculated and measured values of the work per unit volume of metal removed by grinding.

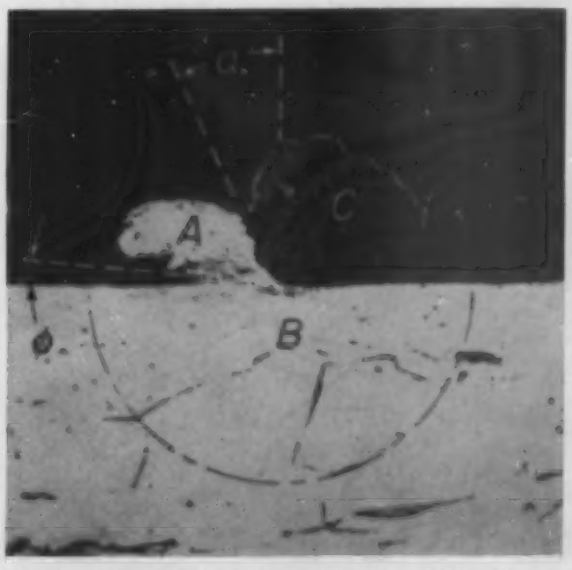
Others have presented evidence of a "size effect" in metal cutting analogous to the increase in breaking strength of fine wires and glass fibers with decreasing diameter. They have shown that, as the size of the chip is reduced, the energy required to remove a unit volume of steel increases to a maximum limiting value. They attribute this behavior to the possibility that the chips become so small that, in order to form them, it is necessary for the metal to shear between the structural inhomogeneities which normally cause the observed macroscopic shear strength to be much lower than the theoretical maximum. It has been suggested that at least a part of the "size effect" can be explained by the energy absorbed in plastic deformation of the surface of the workpiece.

Effect Upon the Abrasive

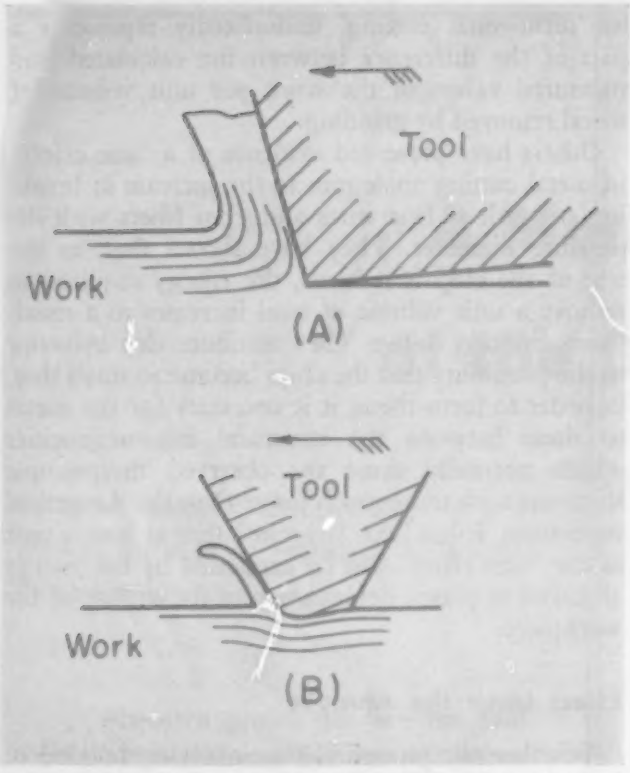
Whether the process is one involving bonded or loose abrasives, there is experimental evidence for the fragmentation of grains during grinding. Examination of the swarf from almost any grinding operation will reveal broken abrasive grains intermingled with the chips from the work. The crushing of silicon carbide and aluminum oxide during the lapping of brass and steel specimens has been investigated. The results, given in figure 5, show a regular decrease in grain size with lapping time. They also reveal that aluminum oxide grains crush more easily than silicon carbide. While this observation is con-



2. Photomicrograph of chip formation in orthogonal cutting.



3. Formation of chip A from workpiece B by an abrasive grain C; diameter of enclosing circle is 0.0025 in.

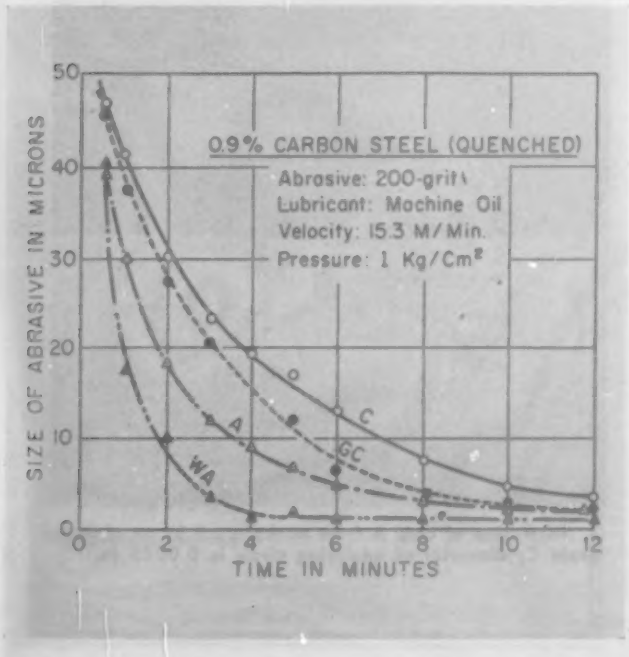


4. Comparison of chip formation by an orthogonal tool A and a geometrically idealized abrasive point B.

trary to a commonly accepted notion, it agrees with other findings.

In addition to the macroscopic fracture of the abrasive grain, cutting points in contact with the work become dull or "glazed" either through the loss of extremely fine particles or through actual solution in, or chemical reaction with, the work. Sharp cutting points first become dull and, as grinding proceeds, flat areas appear. Figure 6 is a photomicrograph of a 46-grit aluminum oxide wheel, vitrified bond, freshly dressed with a diamond tool. The light areas are pulverized bond and abrasive resulting from the truing operation. A similar wheel is shown in figure 7 after removing 0.046 cu. in. of metal from the surface of annealed tool steel bars. Figure 8 is a similar wheel after removing 0.87 cu. in. of annealed tool steel under identical conditions. The sharply defined light areas are flats worn on the tips of the grains in contact with the steel surface. Close examination reveals streaks or grooves in these areas running parallel to the direction of abrasive motion.

5. Fragmentation of silicon carbide C, green silicon carbide GC, aluminum oxide A, and white aluminum oxide WA during lapping.



Although the relative hardness of the abrasive and the work for a long time was believed to be the determining factor in the rate at which dulling or "glazing" takes place, there is now evidence that chemical reaction between the abrasives and the work is also a factor. Boron carbide (2800 Knoop) and silicon carbide (2500 Knoop) are both harder than aluminum oxide (2000 Knoop), yet both dull more rapidly on steel than the latter. This difference is believed to be due to the greater solubility of the carbide abrasives in steel. On the other hand, when grinding glass, aluminum oxide dulls at a rate too high to be explained by the relative hardness of the abrasive and glass. The penetration hardness of glass is much lower than that of aluminum oxide. In fact, it is even lower than that of hard steel which, as just noted, is ground more efficiently with aluminum oxide abrasive. Again, the cause of the dulling seems to lie in the greater solubility of aluminum oxide in glass. Thus, when stock removal is the chief concern, aluminum oxide is used to grind steel and silicon carbide to grind glass. If burnishing of the work to give it greater luster is desired, dull grains are needed and the procedure is reversed; silicon carbide is used to grind steel and aluminum oxide to grind glass.

Ground surfaces and the grinding swarf have been examined by means of electron diffraction and electron microscopy. Concern was with the lapping of metals on a cast-iron lap, using 220-, 400- and 800-grit aluminum oxide and chromium oxide having an average particle size of about 2 microinches. It was found that in wet lapping aluminum bronze, brass and phosphor bronze, the surface remained crystalline, but that in dry lapping it generally became amorphous. (In wet lapping, a comparatively large amount of abrasive and lapping fluid is found between the work and the lap; in dry lapping, there is little of either.) Steel hardened to Rockwell C 65 behaved similarly to the softer alloys except that the surface remained crystalline as long as aluminum oxide abrasive was used, regardless of its fineness, and plastic flow started only when chromium oxide was substituted as the abrasive. Here is another bit of evidence that abrasives are to a certain extent specific in their action upon surfaces and that the

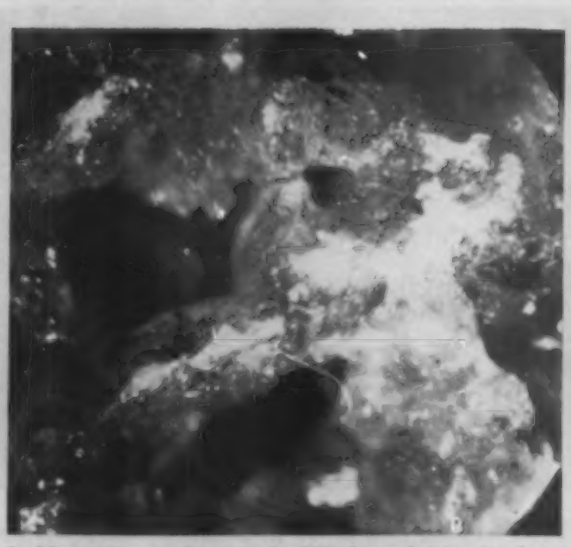
choice of an abrasive depends upon the material to be ground or polished.

Effect Upon the Chip

The mechanism which gives birth to grinding chips causes them to be severely plastically deformed. The heat generated by this distortion, plus that arising from friction between the chip and the abrasive, causes the chip temperature to rise quickly to a rather high value. In materials having different allotropic forms at different temperatures, this effect can give rise to phase transformations in the chip.

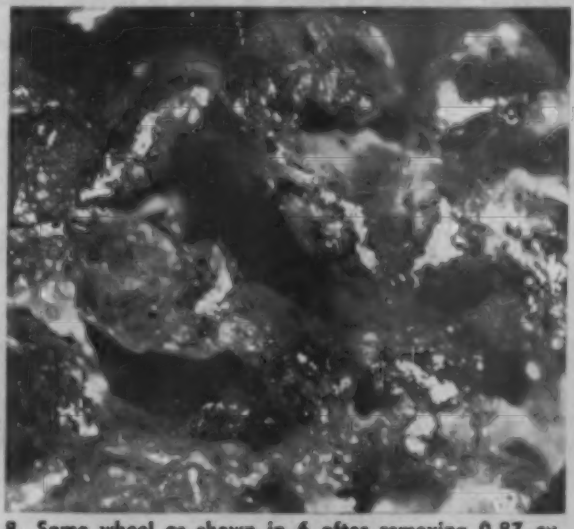
Grinding chips have a high ratio of surface area to volume. The surfaces are freshly formed and can react readily with any chemically active substances with which they come in contact. Since they already are hot, it is not surprising that the chips from certain materials undergo surface oxidation at such a rate that combustion takes place, giving rise to the familiar spark stream. It is a common misconception that the glow of the spark stream is an indication of the temperature of the chips at the instant they are formed. Although the chips may be hot enough to glow at the instant of formation, it has been shown that sparking is primarily the result of heat generated in an exothermic reaction between the chips and the surrounding medium. It has been demonstrated that no sparks are observed when grinding steel in an atmosphere of pure nitrogen or helium under conditions which produce abundant sparking in air. Experiments also reveal the importance of oxygen to power consumption in dry grinding. The power required to grind steel in pure nitrogen or helium can be as much as 25 times that required to grind in air under otherwise identical conditions. The addition of a trace of air to either of the pure gases causes the power consumption to fall to its atmospheric-air value. This behavior is believed to be due to the formation of a thin oxide layer on the freshly formed surfaces which reduces the frictional force between the chip and the abrasive and prevents the chips from rewelding to the workpiece.

Examination of the swarf resulting from grinding steel in air discloses hollow spherical shells resulting from the complete burning of some of the chips, long bright continuous chips such as might be formed by a miniature single-point cutting tool, and chips which are partially burned and have an oxidized shell attached to one end. Such a sample, obtained by severely grinding hardened tool steel, is illustrated in figure 9. In the right center of the photomicrograph in an abrasive grain torn from the 46-grit wheel during grinding. To the left of it is a long chip extending vertically with a spherical shell at its upper end, indicating that it has partially burned. Elsewhere on the figure there are spherical shells with no chip showing, indicating that the chip has burned completely. In the upper left is a

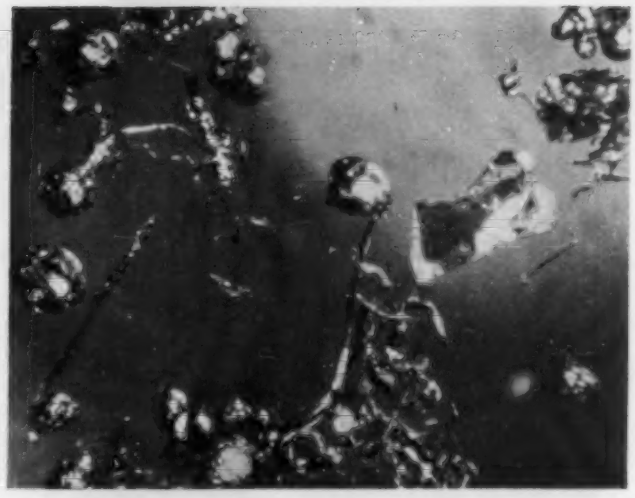


6. Photomicrograph of a freshly dressed 46-grit aluminum oxide vitrified wheel, 50X. White areas are pulverized abrasive and bond resulting from the truing operation.

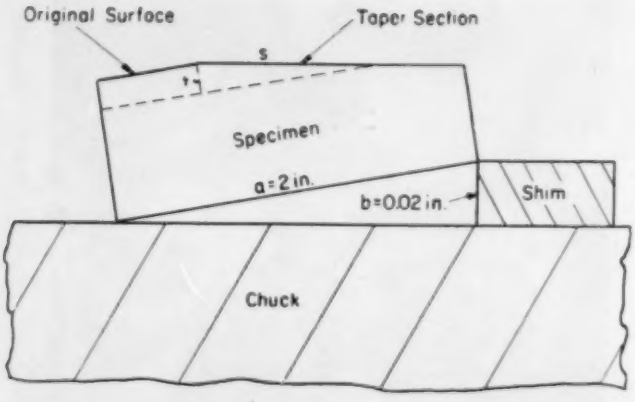
7. Photomicrograph of wheel similar to that in 6 after removing 0.046 cu. in. of metal from the surface of annealed tool-steel bars, 50X. Note long slender chip at lower right and metal clinging to tips of abrasive.



8. Same wheel as shown in 6 after removing 0.87 cu. in. of annealed tool steel under same grinding conditions used in obtaining 7, 50X. Light areas are grains worn flat by contact with the steel.



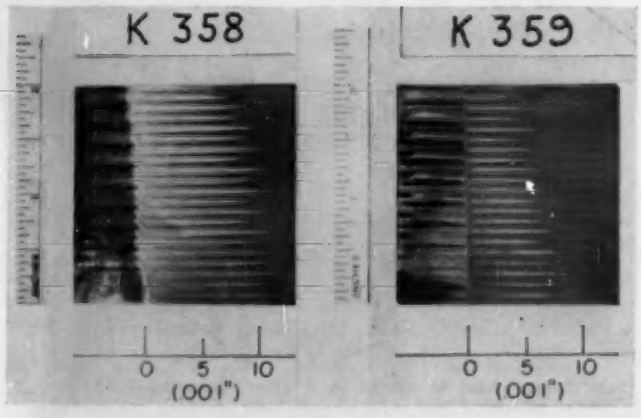
9. Swarf resulting from severe grinding of annealed tool steel. Aluminum oxide grain at right center is about 0.015 in. long.



$$\frac{s}{t} = \frac{a}{b} = \frac{2}{.02}$$

$$s = \frac{a}{b}t = 100t$$

10. Geometry of taper section illustrating one method of generating taper. Specimen is placed on chuck of surface grinder with one edge shimmed and gently ground with a soft wheel. Metal disturbed by grinding is then removed by lapping, followed by metallographic polishing.



11. Taper sections of abusively ground hardened tool steel surfaces. Scales at bottom show depth below the original surface.

slender spiral chip which, except for size, looks as though it had come from a lathe. It is important to note that the cross sections of the chips are very much smaller than the abrasive grain. This supports the explanation of the failure of orthogonal cutting theory to account for all the work done in grinding.

Effect Upon the Work

What happens to the abrasive and to the chips is usually of little concern in comparison with what happens to the workpiece in a grinding operation. As in the case of both the chip and the abrasive, the surface of the work experiences a temperature rise caused by heat generated in plastic deformation of the material ground and by rubbing of the abrasive against the surface.

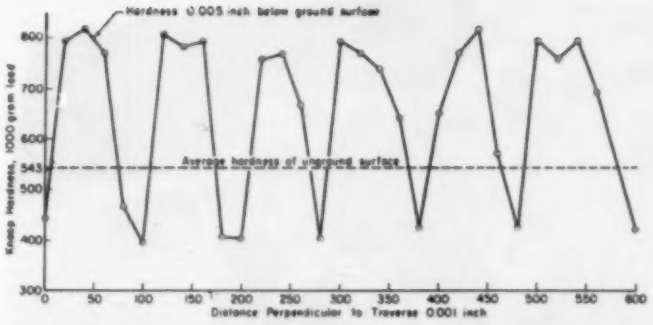
Abusive Grinding

The thermal effects of abusive grinding are sometimes directly observable. For example, the oxidation caused by high temperatures generated in the region of contact with an abrasive wheel results in the discoloration of steel surfaces, which is called visible burn. Less abusive conditions can bring about a modification of the structure or mechanical properties of the workpiece without visible evidence on its surface. This is known as invisible burn. Occasionally the material responds to some postgrinding treatment in such a way that evidence of invisible burn can be brought out. This is true of martensitic steel when etched in a dilute solution of nitric acid. Local areas which have been tempered by the heat of grinding etch darker than the surrounding material. If the local temperature does not rise too high, it has no appreciable effect on mechanical properties. On the other hand, if it rises enough to cause an appreciable amount of tempering, the hardness is reduced and a "soft skin" results.

If the grinding is very severe, the temperature may rise sufficiently high to cause local areas of the surface to transform from one solid phase to another. For example, local areas of hardened and tempered steel surfaces may be rehardened by abusive grinding, indicating that temperatures above the critical range for transformation of tempered martensite to austenite and vice versa, 1330 deg. F. (723 deg. C.), are reached.

Taper Sectioning

Taper sectioning is a convenient technique for studying thermal effects at known depths below the surface of steel which has been ground severely. By preparing a plane surface which intersects the ground surface at a slight angle, a magnified cross section of the latter can be examined. The geometry involved is illustrated in figure 10, and the photographs in figure 11 show two such taper sections



12. Microhardness measurements at a depth of 0.005 in. on specimen K 358 in 11.

of steel which has been ground abusively to bring out more strikingly the effects of excessive grinding heat. The pointed, light etching areas are metal which has been heated above the critical temperature by grinding and has rehardened upon cooling. The intervening dark areas have been overtempered by the heat of grinding, having not quite reached the temperature necessary for phase transformation. Note how the etching reveals these areas even on the original surface. The regular spacing of the light and dark streaks corresponds to the 0.1 in, crossfeed of the work at the end of each table stroke.

Taper sectioning is particularly useful when supplemented by microscopic examination, X-ray diffraction, or microhardness measurements. Figure 12 illustrates the use of a microhardness tester to explore the taper section of the specimen at the left in the preceding figure. Points above the dashed line representing the average hardness of the unground specimen correspond to the light rehardened streaks, while those below correspond to the intervening tempered areas.

Thermal and Mechanical Stresses

The thermal and mechanical stresses in the surface of the work, resulting from chip formation and removal, may exceed the elastic limit of the material and cause plastic flow. Some of the work done in the plastic deformation remains in the surface in the form of strain energy with which there is associated a residual stress. Experiment proves that the stresses resulting from surfacing operations, such as machining, grinding, lapping or polishing, are biaxial in the plane of the surface.

The magnitude and depth of penetration of the surface stresses depend upon the material ground and the severity of the grinding conditions. For example, the stressed layer in annealed mild steel is thicker than in annealed tool steel ground in the same way. This observation is illustrated in figure 13 which also shows that the thickness of the layer increases with the depth of cut.

It is an experimental fact that specimens of glass and plastic exhibit the same type of biaxial bending after surface grinding as steel specimens of the same dimensions. The fact that a brittle material like glass is deformed plastically may at first seem inconceivable; however, the temperature in the cutting region is apparently sufficient to permit flow to take place under the stresses acting.

Conclusion

Much has been written about the deleterious effects of abusive grinding upon the service life of ground parts. Unquestionably abusive grinding can damage a surface, but that is not sufficient reason for foregoing the efficient stock removal, fine finishes and dimensional accuracy which good grinding practice affords. One does not abstain permanently from food because overeating makes him ill. Instead, he practices moderation in order to enjoy good health. Much the same is true of grinding. It was proved by fatigue tests that the endurance limit of ball-bearing steel is reduced 20 or 25 per cent by severe grinding. Gentle grinding, on the other hand, gives the same endurance limit as the best recognized methods of preparing fatigue specimens. It is thus apparent that the grinding conditions are extremely important in determining both the appearance and the serviceability of ground parts. ● ●

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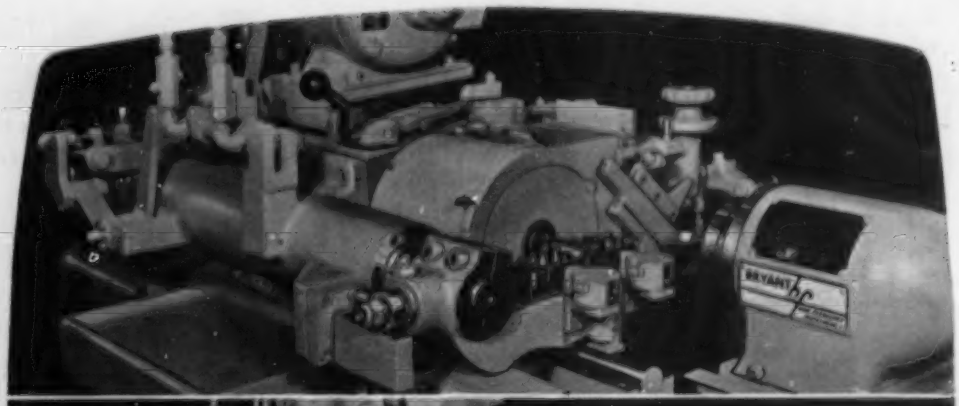

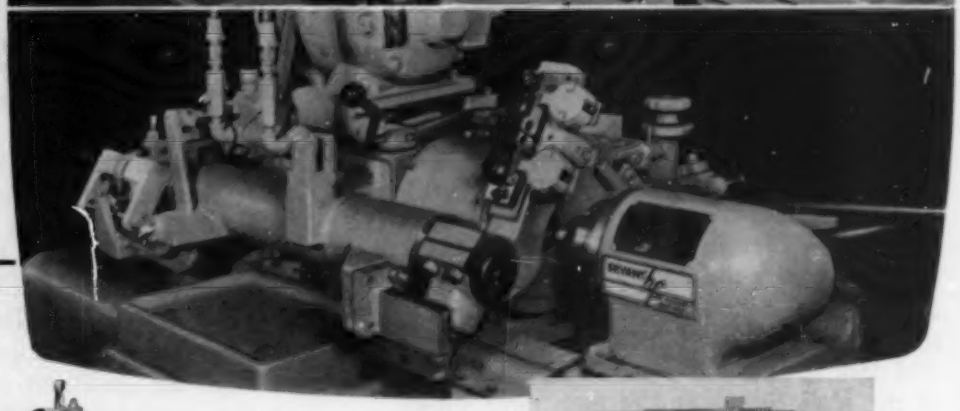

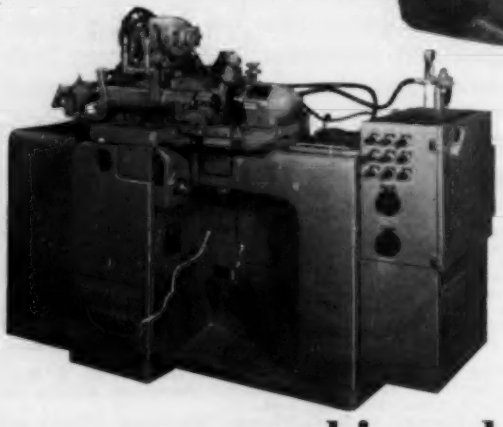

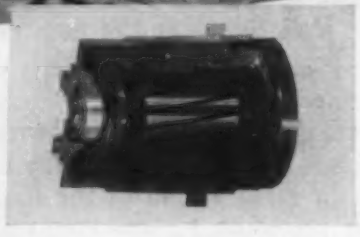

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- ✓ keeping at a minimum the amount of metal to be ground off
- ✓ doing the grind on the most suitable machine
- ✓ using appropriate grinding pressures
- ✓ elimination of vibration in the machine and in the work
- ✓ selection of the most suitable wheel specification through proper testing methods
- ✓ adoption of the most economical wheel sizes and shapes
- ✓ alert supervision of the size of discard stubs and dressing habits

How Foundries Can Reduce Their Grinding Costs

By **A. S. Wyborski,** Director, Sales Engineering Peninsular Grinding Wheel Div. of Abrasive and Metal Products Co., Detroit, Mich.
Detroit, Mich.

THE PROBLEM of evaluating grinding efficiency and determining the cost of grinding is admittedly a complex one, mainly because in the average cleaning room a number of variable factors exist which are difficult to measure due to their randomness. There is considerable ground for debate on such issues as: 1. Most efficient grinding method; 2. type of machines; 3. whether grinding is best done before or after annealing, and innumerable other questions of this sort, all of which are highly debatable and actually must be determined on a basis of preponderate local conditions.

There are basic principles, however, adherence to which does result in greater economy and violation of which results in waste.

Leave Less Metal to be Ground Off

One of the most obvious and self-evident ways of reducing grinding costs is to leave less metal on the casting to be ground off. This remark may appear as over-simplification to a point of ridiculous, yet we can point to a case history in our engineering files of a New England steel foundry where we did nothing more than draw attention to the fact that the torch-cutters were haphazard in how much steel they left to be removed by the subsequent grinding operation. Some close coaching and a little more scrutiny of the quality of their work resulted in an actual 30% reduction in grinding wheel cost per ton of castings processed.

Another point too frequently overlooked that has considerable effect on grinding costs is the location of gates and risers without regard for the accessibility of the area to a grinding wheel. This may force a cleaning superintendent to do a certain grind with a portable machine that would have been more efficiently done on a swing frame grinder. We are all aware that, in locating the gates and risers, the pattern engineer must give first consideration to the quality of the casting. But in many cases location of gates and risers so as to make them readily accessible to the grinding wheel can be exercised without detracting from the quality of the casting.

When the remnants of the gates and risers are inaccessible, grinding costs are proportionately increased because:

1. *Due to their location they may have to be ground on a machine that is not most suitable for that particular job.*
2. *Handling time or setup time are invariably increased.*

Care in breaking off the gates and risers with an eye to leaving the least possible amount will also enhance grinding costs.

Thus it can be concluded that the best and most direct way of reducing grinding cost is to reduce the amount of metal that must be ground away.

Select the Proper Machine

Another factor that exerts considerable influence on grinding costs is the selection of the most suitable type of machine. Of the three basic types, swing frame, floor stand and portable, measured on a basis of cost per unit of metal removed, the swing frame is the most economical, the floor stand second and the portable third. This is due mainly to the fact that in swing frame grinding greater pressures can be employed. Floor stand operations on which a supplementary pressure of some sort is utilized rival the swing frame operation quite closely. Portable grinders should be used where the purpose of the operation is to improve the quality or appearance of the surface, or for grinding areas which cannot be reached by the wheel on a floor stand or swing frame machine.

Castings which are complex in shape are usually routed to a floor stand machine in preference to a swing frame because the complex shapes do not lend themselves to positioning and to being held rigidly during the grind on the swing frame machine. These shapes are best done on a floor stand: however, because the operator must lift the casting in floor stand grinding, the weight of the casting sometimes dictates that it be ground on the swing frame.

Good practice requires that:

1. *Whenever the amount of metal removed is substantial, the work should be done on a swing frame grinder.*
2. *The floor stand should be utilized on all castings which cannot be ground efficiently on the swing frame.*
3. *Portable grinding should improve surfaces, remove light parting lines, or grind areas which are inaccessible to larger wheels.*

Violation of these precepts is bound to result in higher than necessary grinding costs, mainly because the most advantageous pressures are not utilized.

Grinding Pressures Determine Grinding Costs

Grinding pressures are one of the main determinants of grinding costs. While it is possible to use too high a grinding pressure, in the vast majority of cases the fault lies in using too little pressure. The resulting inefficiencies are: 1. A reduced rate of metal removal and, 2. a wheel grade that is too soft to hold the abrasive grains until they have fractured a number of times. On floor stand operations where the pressure applied is only that which the operator is capable of generating physically, with no assistance from a leverage device of some sort, the grade of wheel used is usually too soft to render a good grinding cost, because the grade hardness of the wheel is limited by operator objection. The adoption of leverage devices in floor stand grinding would obviously preclude operator complaint and give a more favorable ratio of wheel consumed to metal removed.

Increasing the pressure on a swing frame operation is simply a matter of adding weight to the machine in the vicinity of the wheel head. Here the limiting factor is the type of work being ground. If the machine must be highly maneuverable to get at various areas requiring grinding, a heavy machine is undesirable to the operator because it is more tiring to him. If, however, the areas to be ground are readily accessible and few in number, thus enabling the operator to remain in the approximate vicinity for a substantial period of time, the added weight on the machine will result in a faster rate of removal, with less force applied manually by the operator. The combined result of this is the practicality of using a harder wheel specification.

In our studies of grinding pressures, we find that efficiency increases as the pressures are increased, along with wheel grade, of course, up to about 350 lbs. psi. Beyond this point efficiency tends downward due to the interaction of several factors which time will not allow us here.

In the field the amount of pressure that can be used is sometimes limited by the available power. If the machine is underpowered so that the right amount of pressure would slow the wheel down, then the lower pressure should be used as the lesser of two evils. This reduction of peripheral speed under applied pressure is uneconomical as well as unsafe. Since the rate of removal is directly proportionate to the peripheral speed of the wheel, the uneconomical aspects of this condition are self-evident.

Because the peripheral speed of the wheel, together with the amount of pressure applied, governs the rate of metal removal, it is essential to maintain or restore the peripheral speed to the maximum allowed by safety as frequently as practical. A wheel of a given grade will actually grow softer in effect as its surface speed is reduced. This, of course, results in a continually deteriorating ratio of wheel consumed to metal removed. Moreover, the rate of metal removed is reduced proportionate to the decrease in peripheral speed. Therefore, full advantage must be taken of the opportunity to restore the peripheral speed to the maximum allowed, which in the case of resinoid bonds is 9500 sfpm for virtually all grades

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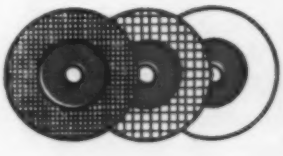

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of wheels used for snagging. It should be emphasized, however, that where speed changes are utilized, care must be taken by supervision to insure that operators do not change speeds prematurely, that is, before a wheel has attained the prescribed diameter. Otherwise, overspeeding and possible breakage may result.

Too low a grinding pressure is inefficient because it is accompanied by a low rate of metal removal and because it creates a condition in which too soft a wheel grade must be used, and higher grinding pressures result in increased efficiency.

Vibration is Costly

One of the most destructive forces to a grinding wheel is excessive vibration. On numerous occasions we have found the life of a wheel increased considerably merely by replacing the spindle or bearings on the grinding machine. Vibration has the effect of innumerable hammers striking the wheel face as it rotates, chipping away fragments of the wheel before the grains have done any work. This is wasteful wheel wear. The same sort of waste results from using a wheel that has worn itself out of round.

The work itself, i.e. the manner in which it is held during the grind, may be the source of vibration. On swing frame operations in particular, if the weight of the casting is insufficient to hold it down rigidly, the use of a magnetic table or pneumatic chuck will eliminate the tendency of the work to vibrate, thus doing much toward improving grinding wheel efficiency.

Wheel Selection

The greatest single factor affecting grinding cost is the selection of the wheel specification, or the grain and grade. Basically, the most suitable wheel for a given operation is the wheel that renders the greatest amount of production at a given rate of cut. Wheel life alone is obviously not a real determinant of efficiency, nor can a wheel's efficiency be judged on a basis of cutting ability alone. In most cases the minimum cutting action of a grinding wheel is determined by operator acceptance which, in turn, is hinged on his ability to make his daily earnings with an effort that he considers normal. With this basic requirement having been met, the production per wheel then becomes a criterion of its efficiency. This is the usual method of comparing one wheel against another in an on-the-job test. In the case of a new operation on which the job rates have not been established, we have the additional task of determining the most advantageous ratio of wheel durability vs the rate of cut. Usually, this point of optimum efficiency, i.e. that certain wheel hardness that will provide us a wheel cost which is in balance with the labor and overhead cost—this point is determined by trying wheels of various hardness.

It is readily apparent that since the selection of the wheel specification is done by test, it is important that the testing method be a sound one. In a grinding wheel test, as in any test, the results cannot be considered conclusive unless the existing variables are controlled. If it is impossible or highly impractical to control these variables, and this is rather frequent in many foundry cleaning rooms, then the variables must be averaged or neutralized. This is accomplished by running a sufficient number of wheels in the test to include a typical cross-section of the work normally encountered, and to employ all or at least most of the machines and operators. I commonly refer to the variable factors in a grinding wheel test as the three M's: the man, the metal and the machine. Unless these three factors are controlled, averaged or neutralized, the results could quite possibly be misleading. The consequence, of course, is the adoption of a certain wheel that may not be the most economical for that job.

Selection of Wheel Sizes and Shapes

Another way of decreasing grinding costs is to use the most economical wheel sizes and shapes. Generally, the larger wheels afford a lower cost per cubic inch of abrasive. For example, the cost per cubic inch of usable abrasive in a 24 x 3 x 12 wheel is 6.68c as compared to that of 8.81c in a 20 x 3 x 12, based on a 15" discard stub. This constitutes a reduction of 25% in the purchase price. The difference would be relatively greater when comparing a 30" wheel against a 24".

On portable operations the use of cones should be avoided unless absolutely necessary. Here, too, the cost per cubic inch of abrasive is considerably higher in a cone than in a straight wheel. Comparing a Type 16 cone against a straight wheel, the cost per cubic inch abrasive is 16.29c and 6.56c respectively, or more than twice as much in the case of the cone. There are jobs, of course, where cones must be employed, but care should be taken to prevent their use on areas that can be ground with a straight wheel.

In the use of disc-type wheels employed for side grinding, economy dictates that the widest possible wheel be used, because here again the prices are based on a degressive scale. The cost per cubic inch usable abrasive in a 30x1x12 disc wheel is 8.14c as compared to 6.58c for a 30x2x12 disc, a difference of 19%. ● ●

TAILOR-MADE SPECIFICATIONS CREATE A STERLING "Wheel of Industry" TO SOLVE ANY GRINDING PROBLEM

There are millions of abrasive grains in a grinding wheel, depending upon the measurement and shape of the abrasive unit, size and combinations of those grains. By having wider than usual range of grain sizes in many of its specifications, Sterling widens the scope of its grinding wheel service . . . makes wheel selection more precise and practical. Sterling engineers are on call. No obligation, write today.

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STERLING ABRASIVES

STERLING GRINDING WHEEL CO., TIFFIN, OHIO

A SUBSIDIARY OF

ABRASIVE AND METAL PRODUCTS CO.

A&MP COMPANY

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A
grinding and finishing
SAFETY FEATURE
DON'T use a wheel that has been dropped
SPEED LIMIT RPM
DON'T ever exceed maximum operating speeds established for the wheel
DON'T grind on the side of the wheel unless wheel's designed for it
DON'T jam work into the wheel

Guilty or Not Guilty

By **Edmund Mottershead,** President
Mottershead Associates
Chicago, Illinois

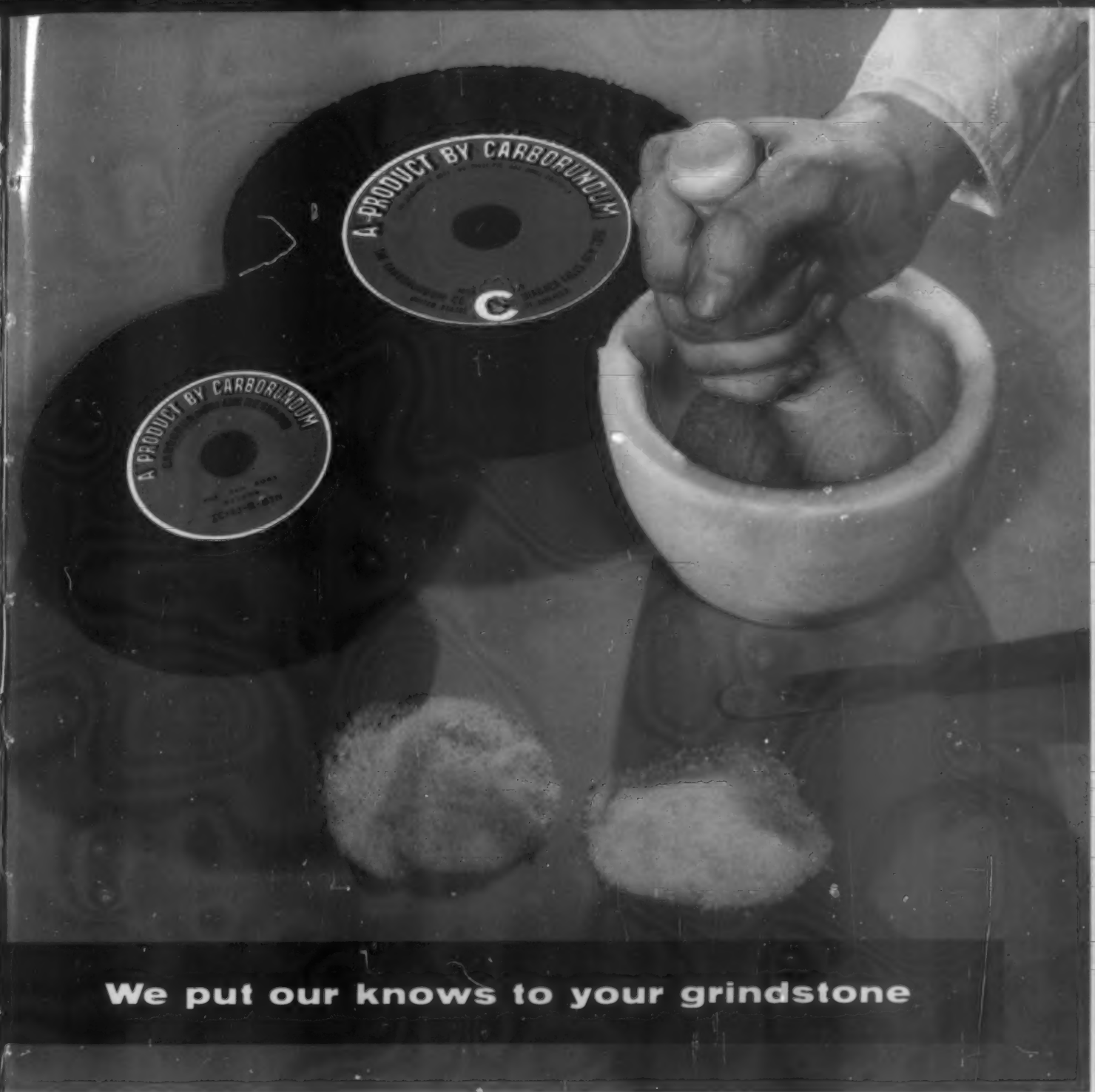
● THE GRINDING WHEEL is probably the most universally used tool in all industry. It is such a familiar piece of equipment that many workers assume they know all about it, even though they may have run one only once or twice for a moment or two without proper instruction. That's why it is so important to review safe grinding practices from time to time to make sure that all operators take advantage of the safety built into the grinding wheels and grinding equipment by the manufacturers.

The plant doing grinding starts out with correct procedure by buying the proper tool and correct wheel for the job to be performed. Storage and inspection, mounting and guarding and basic job training are provided by the plant and the wheel manufacturer. From then on, it's up to the operator.

As somebody said: "An accident is a Careless Joe going somewhere to happen." Trouble can start when several men may use the same machine; one man's carelessness too often results in an accident for the other fellow. The man who bears down too hard, heats up the surface of his wheel too fast and starts small cracks, leaves a potentially dangerous wheel for the next man. The man who operates a wheel which is running too fast not only runs a risk but leaves potential trouble behind him. Every operator needs to check his equipment **before** he runs it, **while** he runs it, and **after** he has finished the job and shut it off. And this safe practice, incidentally, applies to every machining operation, not only grinding.

In the little quiz presented here, we ask: Are you GUILTY, or NOT GUILTY? If you're not guilty, you get a good score. Put a check mark for either "yes" or "no" in the proper blank after each item.

Add your YES and NO answers. If you have less than 5 YES marks, you're exceptional. From 5 to



We put our knows to your grindstone

Ever since the first man-made abrasive was trademarked CARBORUNDUM, outstanding research developments in grinding wheels have consistently come from the laboratories of THE CARBORUNDUM COMPANY. The development of a new grinding wheel by CARBORUNDUM is a carefully controlled scientific process... involving three to five years of research, engineering, and field trials. New resinoid bonds are constantly being developed for wheels that will grind cooler, cut faster and last longer, even on the new "miracle metals" and alloys. That's why your CARBORUNDUM Distributor or salesman offers the finest, the most complete lines of wheels you can buy... made by The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

(Guard lifted and coolant flow stopped to reveal belt action.)

PHOTOGRAPHED AT BELL AIRCRAFT CORPORATION.

86 inches wide, in fact—by 138 inches long...*all* belt! Here's why: to generate taper of the required precision on huge aluminum aircraft "skins," conventional milling methods were far too slow and costly. So CARBORUNDUM abrasive engineers, in collaboration with the Air Force, Bell Aircraft Corporation, and the Hill-Acme machine people, designed and produced this special belt, in proper gradings to meet the rigid specifications of surface finish and dimensional accuracy.

● If *you* are stymied by an unusual grinding problem, turn to the source with the greatest experience and application "know-how" in the abrasive field today! Call in your CARBORUNDUM Distributor or salesman, or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.

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10 YES answers puts you in the class with the genrally good operators, although some of these "boners" no good operator will ever do. If you have as many as 15 YES answers, you need quick retraining by the foreman or leadman, if not even stronger treatment, and if you have 20 or more YES answers, you're a positive menace, and I wouldn't work in the same shop with you!

Grinding wheels are safe, if used for the jobs for which they were designed and at the speeds for which they were built. Grinding machines are safe if guards and accessories provided for them are in place and adjusted. Grinding jobs are safe—if the operator is on the ball. It's up to you!

GRINDING MACHINE OPERATOR'S CHECK-UP CHART Here are 25 ways to get into trouble while grinding.	GUILTY OR NOT GUILTY? Are you GUILTY? YES	 NO
1. Failure to use goggles, face shield, or grinder shield		
2. Holding the work improperly, too loose, too tight, etc.		
3. Grinding without work rest or with rest out of adjustment		
4. Gaging work, cleaning or adjusting machine while machine is in motion		
5. Working with machine that has improper wheel guards		
6. Operating grinder with excessive wheel speed		
7. Using the wrong wheel for the job		
8. Side grinding on wheels not designed for it specifically		
9. Using machine without proper authorization or training		
10. Failing to maintain wheel or using wheel which has not been maintained properly		
11. Bearing down too hard—taking too heavy a cut		
12. Applying work too rapidly to a cold wheel		
13. Operating cracked or damaged wheel		
14. Operating wheel which has obvious vibration		
15. Use of bearing boxes without ample bearing surface		
16. Using spindle with incorrect diameter for wheel hole		
17. Using spindle with threads so cut that nut tends to loosen as spindle revolves		
18. Operating grinder with control switches out of reach		
19. Dressing wheel incorrectly		
20. Grinding too high above center line of wheel		
21. Operating grinding wheel which is out of balance		
22. Failing to use proper wheel washers (blotters)		
23. Using flanges with unrelieved centers		
24. Using wrong size or unequal flanges		
25. Using grinder with unguarded transmission parts		

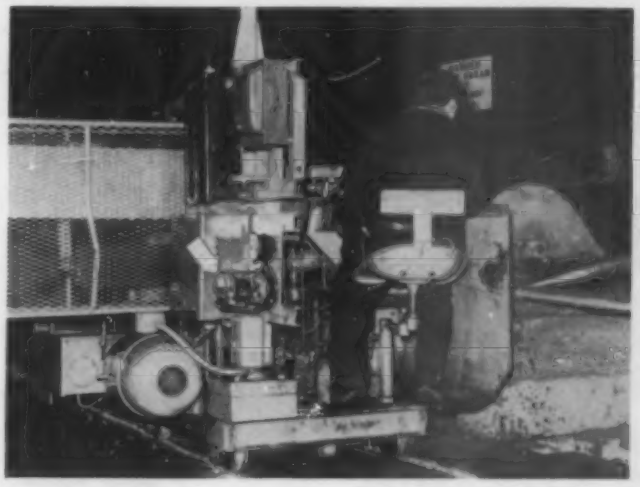
Workometer Measures Daily Operator's Output

A new measuring device for industrial application which measures the operator's work output has been introduced to grinding shops.

The device, made by Stewart Instrument Co., 6507 Grand River Ave., Detroit, furnishes a visual means of determining the amount of work performed and the operator's pay, each day, without complicated rate figures. The Workometer measures the operator's output in work units instead of pieces or time. It can be installed on electric, motor-driven production machines. The manufacturers claim it will reduce costs in timekeeping, payroll, time study and standards departments.

The basic problem of measuring accurately the operator's work is to establish the rate of doing work multiplied by the time in which the work is done. The measured Work Units represent the total electric energy (grinding time multiplied by rate of grinding) which is consumed in grinding cycle.

This Workometer measures work for operators of special slab and billet grinders in a steel mill.



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"TRU-LINE" PROFILE DRESSING TOOLS

IMPREGNATED DRESSING TOOLS

STANDARD DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS

DIAMOND GRIT TOOLS FOR THREAD DRESSING

INDUSTRIAL DIAMONDS

in the American tradition

Twice a day a quick transformation overtook the old frame garage on John R Street, Detroit. At seven in the morning, the doors swung open, a spindly car chugged out and the garage became a busy little workshop. Sometime after dark, the car was driven back in and, for a few hours, the workshop was a garage again.

As a workshop, it had for us a very special significance—it was here that our Company came into being and set up the first local shop devoted exclusively to making industrial diamond tools.

But, far more important, it was the first place in the whole mid-west where industry could find a complete stock of fine industrial diamonds, imported direct to Detroit, and superior to stocks previously available only in New York.

Such convenience is taken for granted nowadays and the mails deliver thousands of our diamond selections yearly, but, in those days, it was an innovation and so useful that in almost no time at all, the old frame garage (which had cost $50.00) needed a 12-foot addition, (which cost another $50.00).

And, that was but the beginning. Today, our plants are the most modern in the industry and in the intervening 45 years our laboratories have pioneered many of the most significant innovations in diamond tool technology, including *Engineered Diamond Tools**.

Thus, in the good American tradition, a far-seeing idea, planted in the humblest beginnings, blossomed into a business that became national and international. And, this year, as we celebrate our 45th anniversary, we salute all of the many friends who helped to bring about this accomplishment.

**Engineered Diamond Tools* are diamond tools *engineered* to the job and *guaranteed* to do it.

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Grinding: a Primary Metal Removal Operation

● Sometimes grinding is thought of only as a final operation, bringing the piece to dimensional size and imparting the required finish. Many production men are likely to overlook grinding as a fast, economical primary metal removal operation, replacing other methods of machining. Here are several case histories, using Besly-Welles, Beloit, Wis., equipment. In future issues the equipment and case histories of other manufacturers will be presented.

A number of Besly-Bowen grinders are used on front flywheel housings; three on rear flywheel housings and one on synchro-mesh clutch housing. Stock removal approximates 3/32" in. plus. Three surfaces are ground on each 40 in. dia. work table in a 65 second cycle time from table to table—or one complete housing each 65 seconds. Housings are held flat within .002 in. and also parallel within .002 in. On numerous occasions these tolerances are held to .001 in. Abrasive wear is only .0005 in. per table load.

Material—Cast armor plate
Size—22"x27"x5.156" high
Surface Ground—
Stock Removal — .030" per surface
Production—12 surfaces per hour
Accuracy — ± .002 size, Flat .0015" + parallel within .0005"
Machine—Wet grinder with rotary magnetic chucks

Material—Steel clutch spring
Size—¾" OD x 1-5/16" long x .175" wire diameter
Surface Ground—Parallel ends
Stock Removal—.210" total
Production — 6000 springs per hour
Accuracy—± .008" size & ½° angularity
Machine — Dry Tandem grinder with oscillating rotary fixture

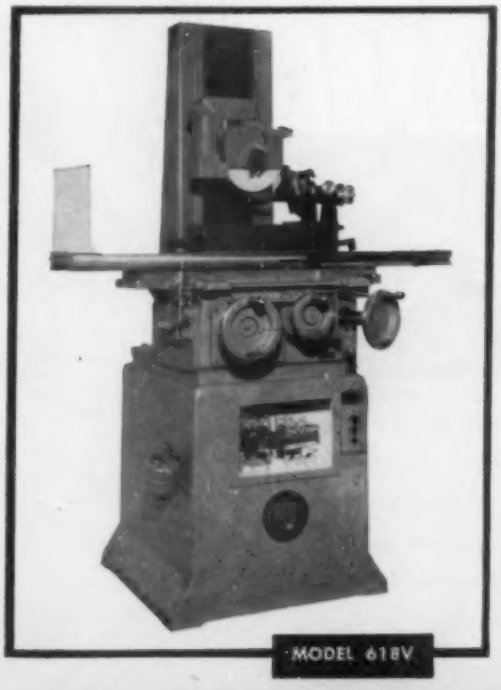
Material—Stamped steel slugs (ammunition)
Size—Approx. 1⅛" OD x 3/16" thick
Surface Ground—Parallel sides
Stock Removal—.007" — .008" per side
Production Rate—10,000 to 12,000 finished parts per hour
Accuracy — Size .002", flat & parallel within .001"
Machine — Wet Grinder with chain feeding fixture and hopper feed

---

Material—Steel forging
Size—Approx. 7½"x3⅝"x1.84" thick (crescent shaped)
Surface Ground — Parallel surfaces
Stock Removal—.080" per side
Production — 200 surfaces per hour
Accuracy—.003" flat and parallel
Machine—Wet grinder with rotary magnetic chuck
This job had originally been considered for milling but grinding offered greater production and accuracy.

in the motor city . . .

REID GRINDERS set the STANDARD for ACCURACY



In Detroit, at Commando Tool and Die Co., positive accuracy is a must in grinding the high-production tooling necessary for today's automobile and aircraft production race. Commando and many other shops in the area have found that Reid Surface Grinders provide the built-in accuracy that spells top performance year after year.

You, too, can have the precision, the better surface finishes, the dependability and convenience of operation that are engineered into every Reid Grinder. So why not plan now to replace the over-age surface grinders in your plant with new Reid Grinders.

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BEVERLY, MASSACHUSETTS

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Now.. for your convenience consumer *net prices* for SIMONDS grinding wheels

VITRIFIED AND SILICATE BONDED

SIZES	PHI	CHI	DET	BOS	SF
6x3/4 (Cont)					
WA46-K8-V2	6				
WA46-K8-V2-1/2 F			12		
WA46-M8-V1	12				
WA46-M8-V1-1/2 F			25		
WA46-M8-V1-5/8 F			24		
WA46-M8-V1-5/8 F	18				
WA60-J8-V1			12		
WA60-J8-V1-1-1/4 F			12	2	
WA60-J8-V1-1/2 F	12				
WA60-J8-V2			18		
WA60-J8-V2-1/2 F	25	8			
WA60-K8-V1					6
WA60-K8-V1-3/4 F	12				
WA60-K8-V2	50				
WA60-K8-V2-1/2 F					

1-9	10	20	50	100	250
$3.10	2.38	2.21	2.04	1.90	1.73

C24-R3-V3	12	6			
C24-R3-V3-5/8 F	12				
C24-U3-V3	12				
C36-P5-V3	12				

1-9	10	20	50	100	250
$3.24	2.49	2.31	2.14	1.99	1.82

SIZES	PHI	CHI	DET	BOS	SF
6x3/4/3/8 (Cont.)					
WA60-K5-V1-1-1/4 F	6				
WA60-K8-V1	50	6			
WA60-K8-V1-1-1/4 F	12				
WA60-K8-V2	12				3
WA80-J5-V1-1-1/4 F					
6x1					

1-9	10	20	50	100	250
$3.00	2.30	2.14	1.98	1.84	1.68

A16-S5-V1	25				
A20-R5-V1	12				
A20-R5-V1-5/8 F	12	5			18
A20-R5-V1-1 F	18				6
A24-R5-V1-1/2 F	200	70	12		45
A24-R5-V1-5/8 F	36				36
A24-R5-V1-3/4 F	200		25		
A24-R5-V1-1 F	18				
A24-S5-V1	18				
A24-S5-V1-5/8 F	6				
A24-S5-V1-3/4 F	6				
A24-S5-V1-1 F					6
A30-05-V1-5/8 F					
A30-P5					

look

HOW EASY IT IS TO USE!

Grinding wheel users will find this book a boon to the problems of grinding wheel pricing and delivery. Here, shown together for the first time, is complete availability of all the stock items of Simonds Grinding Wheels and *Consumer Net Price* per wheel in every ordering quantity.

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SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

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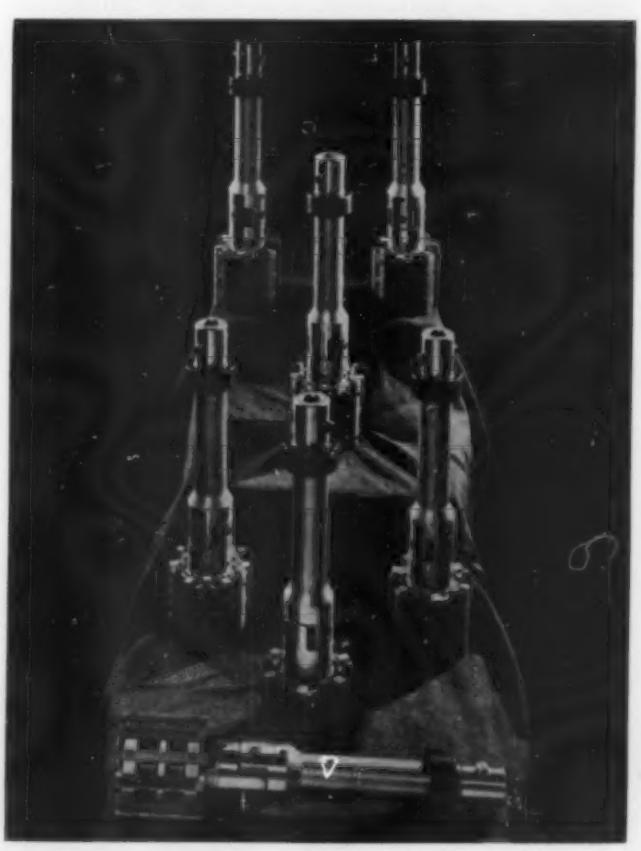
Fundamentals of the Honing Process

By **Robert Polatsek**

- ✓ honing begins with stock removal
- ✓ honing is low velocity abrading which performs a shearing operation
- ✓ abrasive stones are self-sharpening
- ✓ cross-hatch surface pattern acts as lubricant reservoirs
- ✓ generates a geometrically-accurate surface

1. Modern honing tools



INDUSTRIAL HONING, originally developed for production of automotive cylinders has branched out into many fields. Unfortunately, some people still confuse it with surface finishing or put it into the same category as grinding. But while honing performs one of the same functions as grinding—stock removal—the method of doing it varies greatly from grinding, figure 1. And so do the results.

Honing is low velocity abrading which performs a shearing operation. The size of the chip depends upon the character of the abrasive used and the material being machined, figure 2. The thousands of grits in the abrasive cut simultaneously over a large area, removing substantial amounts of stock. Cutting efficiency is maintained throughout the cycle because the abrasive stone is self-sharpening. The large area of contact, the low pressures and speeds used, and cutting edges that are always sharp prevent the occurrence of any localized heating that might injure or distort the surface.

Honing produces a cross-hatch surface pattern (lay) of minute valleys which act as lubricant reservoirs, with the load carried by a multitude of diamond-shaped plateaus. These "characterized" surfaces make up a perfect surface for all types of load-carrying applications, figure 3. Any degree of roughness can be generated and duplicated on every surface. In most instances, honing is the economical

FREE BOOKLET
see how diamond can cut your finishing costs. how to use diamond most economically
Finish with diamond... Elgin Diamond!
ELGIN Diamond
....another famous-for-quality ELGIN Product
Precision graded in Elgin's own laboratories and scientifically compounded for maximum abrasive efficiency ... recognized as the standard for diamond abrasive quality. Elgin Diamond saves hours of finishing time more precious than diamond itself. Write today for your copy of "Finish with Diamond – ELGIN DIAMOND!"
ABRASIVES DIVISION, DEPT. A-1
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

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NEW Apex DISC GRINDER
$247*

EXCLUSIVE FEATURES

1 FORWARD & REVERSE SWITCH
Switch is standard equipment for left and right hand jobs, adds life to grinding disc.

2 WRAP-OVER GUARD
Cannot flip off, keeps fragments out of eyes, rolls back to handle work at top of disc.

3 DRY LUBRICATION
All moving parts of grinder are lubed with dry lubricant, lasts life of machine.

4 COUNTERBALANCED MECHANISM
Table is easily moved up and down in a single motion, exposes full disc surface.

5 SQUARING PIN
Table can be accurately set at any degree, from 45° up or down, is automatically squared when returned to normal position.

* $247 covers model 15-S grinder complete with ½ HP, 3 PH. motor, F.O.B. Los Angeles.

Dealer inquiries invited.
Write for illustrated brochure and price sheet.

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MATTHEW MOODY & SONS LTD.

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2. Honing chips

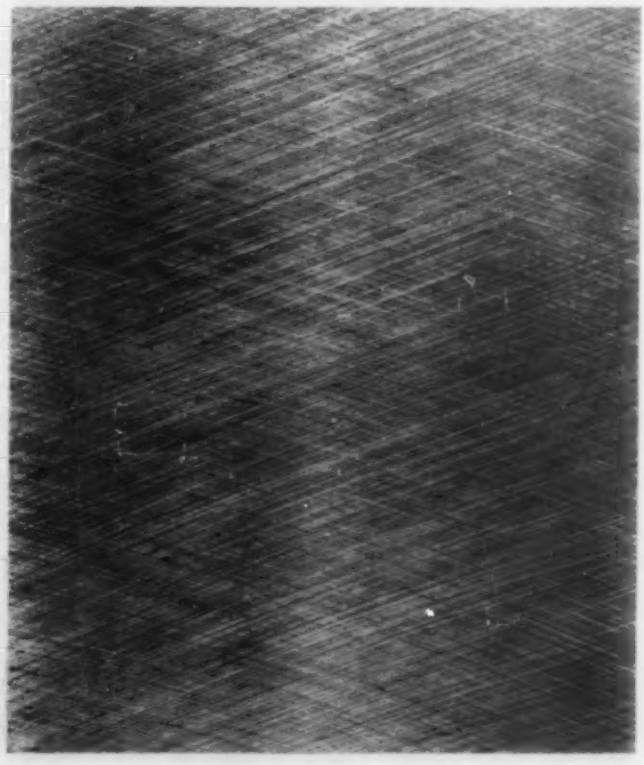
way to get the specified finish. In other instances, it is the only method which can be used.

Interrupted surfaces broken by keyways, undercuts, ports, reliefs or cross-holes can be honed round and straight with any degree of surface finish needed. All sections of the surface are generated from a common center line so all of them are in alignment.

One example of this is production of main bearings in automotive cylinder blocks, figure 4. It runs 60 an hour on specially-built honing machines. Approximately .002 in. of stock is removed from each bearing. Diameter size and alignment are held to less than .0005 in. variation, gauged by a single mandrel, multiple orifice air gauge. Surface finish is held to 40 microinches.

Another application where the honing process has

3. Characteristic honing cross-hatch finish



distinct advantages is in producing reduction pinion gear carrier trunnions for aircraft engines. Both the I.D. and O.D. must be held to precise tolerances for geometry, size and finish. And there are 40 surfaces involved.

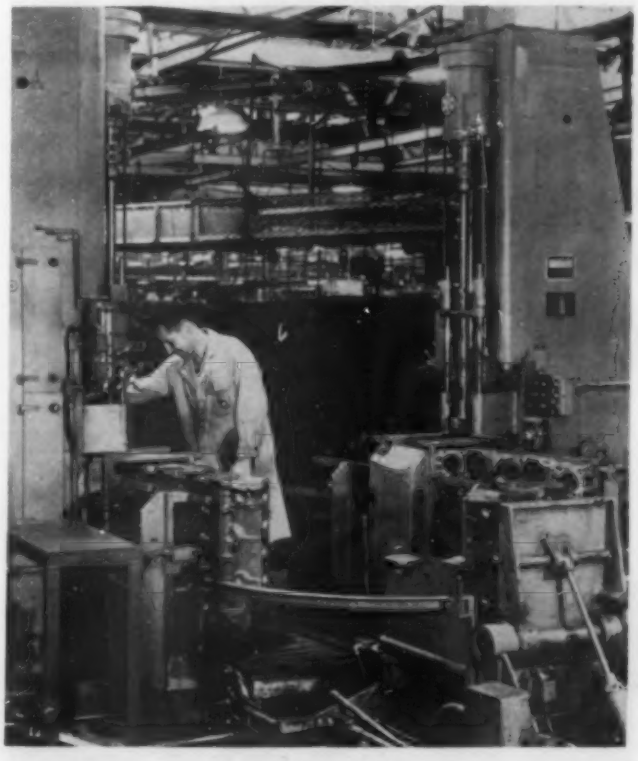
This is done by fixturing the carrier on a rotary indexing table. The I.D. of each trunnion is honed, removing from .002 to .004 inches of stock. Then the tool is changed and the O.D. is honed with a special tool removing approximately the same amount of stock. Surface finishes of 4 to 8 microinches are generated.

The finish on the surface of automotive cylinders is critical. It carries the load of the piston rings, and a running seal must be maintained between the rings and the cylinders. Engine efficiency depends on how well this seal is maintained under extreme compression and temperature.

Honing produces the same required finish on part after part. It generates a geometrically-accurate surface without a waviness which, if existed, would tend to break the seal and allow compression loss. Controlled surface roughness promotes "wearing in" of the rings. And since there is no dead or fragmental metal that might pick up on the rings or cause scuffing, uniform heat transfer takes place more easily.

Using a honing machine the operator merely loads the block onto the fixture. The rest of the operation is automatic. Production runs to more than 70 blocks per hour.

4. Model 740 Microhoning machines generating functional accuracy in main bearings in cylinder blocks. (Microhoning is a trade name of the honing process applied by Micro-fatic Hone Corp., Detroit, Mich.)



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SPECIALTY MANUFACTURERS OF RESINOID BONDED HIGH SPEED GRINDING, CUT-OFF AND COPING WHEELS

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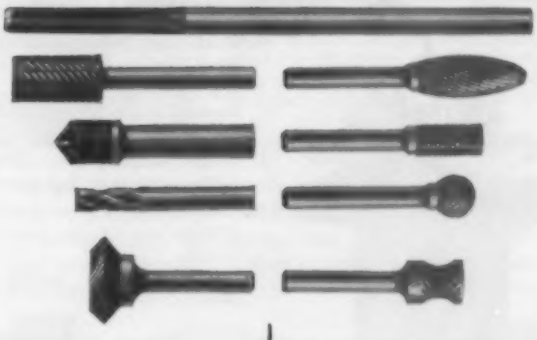

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BOYAR-SCHULTZ
Mounted Grinding Wheels

Specially designed to our own specifications for maximum safety and speed. Arbor shanks are heavy duty steel and are set much deeper into the abrasive than in the usual mounted wheels. Every Boyar-Schultz Wheel is selected and tested. Available in 11 sizes with ¼" shank and in 20 sizes with ½" shank. *WRITE FOR CIRCULAR AND PRICES.*

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2002 South 25th Ave., BROADVIEW, ILLINOIS
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PROSSER **CARBIDE TOOL GRINDERS**

FOR ALL SINGLE POINT TOOLS

• ADVANTAGES

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2. Wet grinding eliminates heat cracking of tools — gives longer life — faster grinding.
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MODEL AA Bench Type
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WRITE FOR LITERATURE

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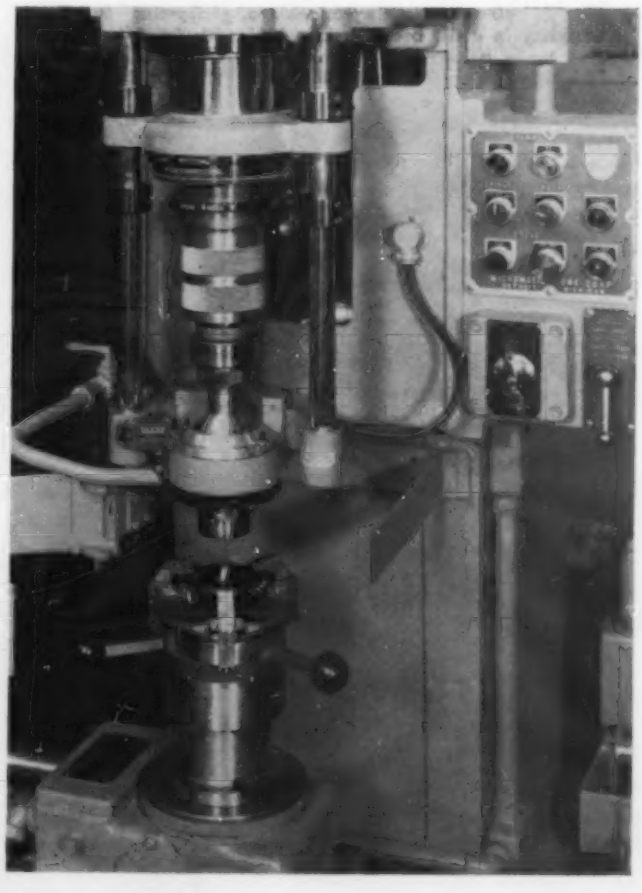
5. Tool used to hone 280 mm gun barrels

Long tubes present still another problem. In boring long gun barrels, for example, the first operations are inclined to result in geometric inaccuracies because of their very nature, figure 5. By honing the gun barrel before the rifling is cut, these inaccuracies are corrected; amorphous metal is removed and the accurate surface generated acts as a pilot for the rifling broach.

In boring long gun barrels, the cutting tool may break or become dull, resulting in rough areas, steps and out-of-roudnness. When the rifling tool is forced through the bore, these spots can cause the broaching tool to hang up, or even break. This causes ex-

6. Tool fixture and size control for automatic honing of splines in hardened gears



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BY CHICAGO WHEEL & MFG. CO.

ABRASIVES ARE AS OLD AS MAN... YET AS NEW AS TOMORROW'S NEWSPAPER!

The earliest traces of mankind indicate no knowledge of abrasion. But, somewhere in the prehistoric ages man learned of the power of grinding down one stone with another. Thus was born one of the world's greatest mechanical aids, the forerunner of today's abrasive industry.

MOTHER NATURE was the first abrader. The glaciers of the ice age, their undersides studded with rocks of all sizes which were held in the ice with considerable firmness, acted as a gigantic grinder in passing over the earth. They abraded, grooved, and polished the rock and terrain. Actually, the glaciers could be likened to the modern grinding wheel, with the imbedded rocks representing the grain and the ice forming the bonding material.

DID MAN learn of abrasives from observing the action of glaciers? Probably not. Scientists tell us that man first knew nothing of the mechanics of abrasion, depending on breaking and chipping rock to form his crude tools and weapons.

FIRST REALIZATION that objects could be worn down by abrasion is supposed to have occurred when aborigines were grinding grain on the simplest form of grain mill. A man (or woman) noticed how the top stone, usually a round smooth one, eventually wore a groove in the larger flat stone.

ACTION of the stones wearing on each other suggested the use of abrading to help shape and form weapons and tools. Archaeologists have found spearheads and other implements that evidence the smoothing action obtained by rubbing stone on stone.

The polishing job that took prehistoric man weeks of toil now could be done in seconds with a modern grinding wheel. Engineering and manufacturing abrasive wheels to parallel man's desire for improvement has been the job of Chicago Wheel for over 65 years.

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Manufacturers of abrasives, precision grinding wheels and mounted points for industry.

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pensive delays and sometimes results in costly scraping of the barrel. Honing is used to remove these inaccuracies. The rifling broach then passes through the barrel easily without damage, saving time and expense on both the boring and broaching operations. In fact, one honing operation has replaced several boring and reaming operations.

Honing splines in hardened gears makes possible mass production of quality automotive gears. These are gears with bearing surfaces on the splines which are not only hard, but have a controlled, characterized surface finish, figure 6.

The problem is to process gears so the bearing surfaces of the splines are hard, concentric with the pitch-diameter of the teeth, straight and round, and have a finish that won't pick up and gall the shaft. The original method required annealing the surfaces before the finishing operation. The result was a soft, torn bearing surface.

Switching to honing solved the problem. Stock removal amounted to .002 in. to .006 in. on diameter; out-of-roundness and taper were held to less than .0003 in.; finish from 15 to 20 microinches; production runs of 35 to 40 seconds per gear, or 350 to 450 gears per 8 hour shift were realized. It was found that gears could be shifted easily on a shaft and would not disengage under load. ● ●

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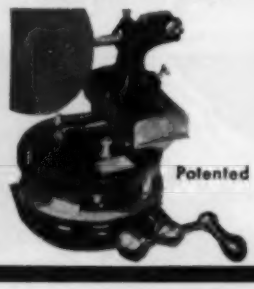
DRESSING
TOOL



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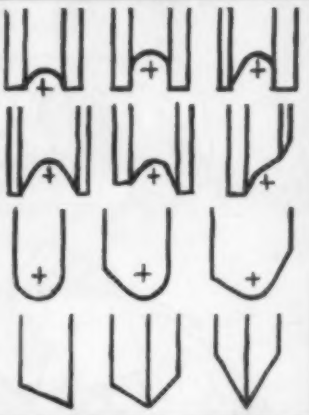

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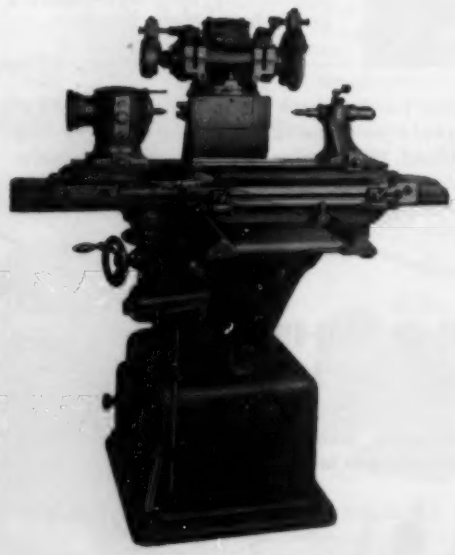

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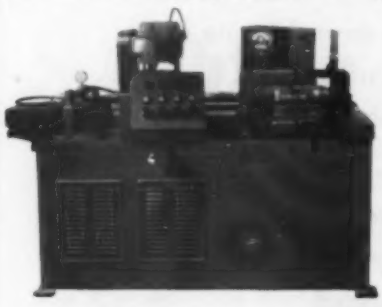
MODEL "SA"

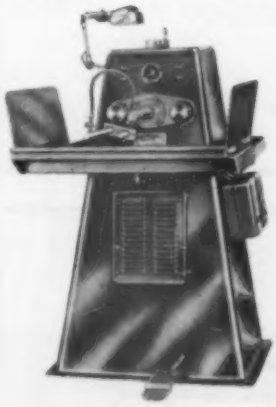
Single-spindle construction with two-position fixture. Can be loaded or unloaded while in operation. Requires but one operator. Automatic air-gaging after each cycle. Honing head, fixture, gages hydraulically controlled. Push-button-signal light type central control panel. Built-in electric timer allows variable cycling. Fabricated steel base contains hydraulic system, coolant tank, electrical control panel. Built to customers' specifications.



MODEL "JCP"

A low-cost, versatile machine. Hones over keyways, spline gears and most broken surfaces. Honing range .120 to 2.500 without adapters. Spindle speeds from 400 to 1000 r.p.m. No changing of belts. All mandrels fit spindle with bayonet lock. Mandrels or stones changed without tools. Stone pressure adjustable by foot pedal. Splash tray expands 10 inches for long work. Easily cleaned coolant unit with adjustable flow.

MODEL "AL"



Permanent type mandrel for long life. Hones over keyways, splines, cross bores. Honing range .120 upwards without adapters. Spindle speeds from 250 to 1150 r.p.m. Anti-friction bearings, oillite bushings, need no lubrication. Tachometer enables quick selection correct speed. Controlled stone pressure. Mandrel runs concentric. Less operator fatigue. Heavy-duty centrifugal coolant pump. Adjustable coolant flow.

MODEL "J"

Versatile, economical bench-type honing machine. Hones over keyways, spline gears, most broken surfaces. Spindle speeds 400 to 1000 r.p.m. without belt change. Hones from .120 to 2.500 without adapters. Mandrels or stones changed without tools. Permanent-type mandrels prevent metal-to-metal contact. All stones ground to size.

MODEL "VH"

Actually a honing head adaptable to most drill presses. Designed for honing work too heavy and cumbersome to hold on machine. Range ⅛" to 3". Dial on bottom of head permits size change during operation. Lever on side releases stone from work and expands stone to same size under spring pressure on next part.

MD-4 DRIVER

For use in drill presses for 3" to 6" honing range. Eliminates need for specially made individual mandrels. Each of 3 expandable mandrels allows for 1" expansion by sixteenths of inch. Set of stones, ground to correct diameter, available for each mandrel. No. 3A-48-64 permits 3"-4" expansion; 3A-64-80, 4"-5"; 3A-80-96, 5"-6". Can be used only with associated MD-4 mandrel driver with No. 2, 3 or 4 Morse taper.

MD-1 MANDREL DRIVER

Makes any drill press a vertical honing machine. Speedier, more accurate hole finishing and sizing at less cost. Ideal for die work, brushings, dowel pin holes. Stones alone come in contact with work-piece assuring long life and eliminating any foreign marks on honed surfaces. Hones to .0001 accuracy. Permanent-type mandrel sizes .120 to 3.000. Available in No. 2, 3 or 4 Morse tapers.

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FROM THE
PUBLISHER'S DESK:

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The staff of GRINDING and FINISHING welcomes the more than 30,000 individuals to whom this first issue has been addressed. The fact that 99% of this audience has been verified before the publication was mailed is unique in the publishing industry . . . and to our knowledge few if any new publications have ever achieved this goal before the first issue! This eagerness on the part of readers is an indication of the need which exists for a business paper to serve an important industry.

Many readers will recognize Hitchcock Publishing Company through its other publications which include five monthlies and three directories. For those who are not familiar with the organization it may be of interest to know that Hitchcock was established in 1898 and pioneered the concept of controlled circulation to completely cover a given field.

The general offices of Hitchcock Publishing Company are located in Wheaton, Illinois . . . a Chicago suburb some 25 miles directly west. Here are located the editorial, circulation and business staffs of all Hitchcock publications.

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Readers should also feel free to write to our editorial staff for assistance and to offer suggestions. Our editors will welcome your letters.

HITCHCOCK PUBLISHING CO.
Wheaton, Illinois

Tool and Cutter Grinding Department

Obtain Big Savings in New Method of Grinding Chip Breakers

By **Joe Kosinski,** Works Manager
Scully-Jones & Co.
Chicago, Ill.

- ✓ less wheel wear
- ✓ grind in one pass to any depth
- ✓ five cents wheel saving per piece
- ✓ grind in half former time

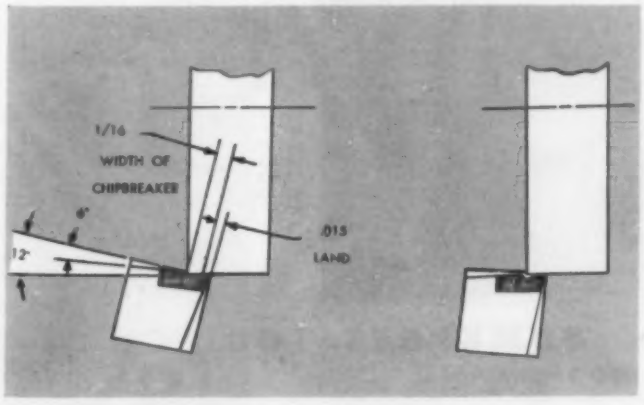
THE GRINDING of carbide chip breakers in our grinding department deviates somewhat from standard practices. This article will outline the new method now being used, and its advantages.

Formerly, we used to grind the side rake angle, figure 1, with a silicon-carbide wheel at 6°, then grind the chip breaker at 12° approximately .015 in. deep, leaving .015 in. land. Our last operation of grinding on the chip breaker consisted of swinging the vise back to 6° and taking a light cut over the cutting land, thus providing a smoother finish on this cutting land.

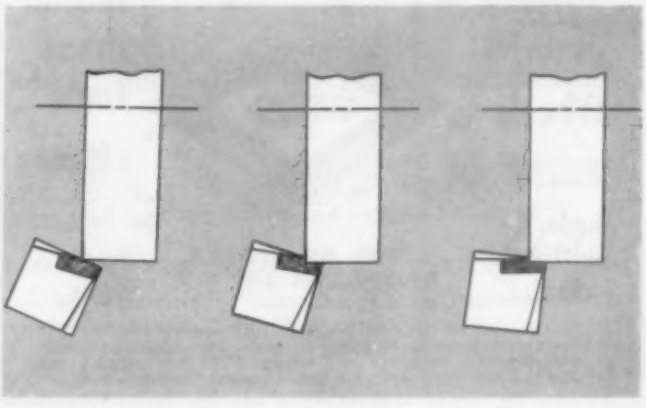
However, we changed our method, figure 2, to get less wheel wear by reducing the wheel wear at the corner caused by the 12° grind. We now use a resinoid diamond wheel 120 grit size, 100 concentration, N hardness bond using a water soluble drip method coolant. The use of the water as a coolant, a ratio of 80 to 1, is merely to prevent rusting.

The conventional grinding procedure is to take light cuts at relatively fast traverse. The downfeeds on chip breaker grinding should not exceed over

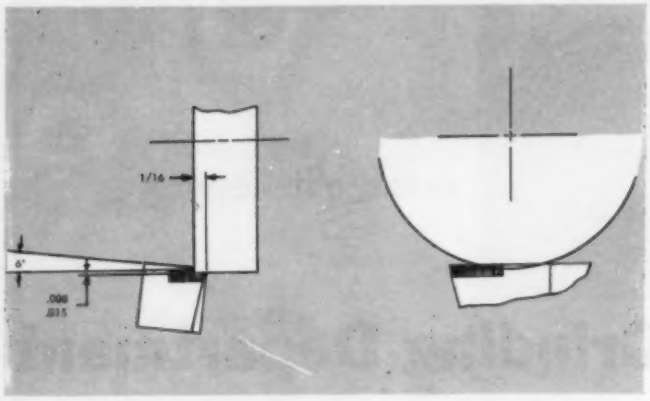
Normal practice of grinding chipbreaker



Old Method **New Method**



Plunge method of grinding chipbreaker



Chipbreaker is ground parallel to top (side) rake angle

.001 in. per pass. This figure, however, is quite frequently surpassed, causing wheel failure.

Diamond, while being the hardest mineral, is also very brittle. Shock against a hard metal such as carbide will result in fracture. Shallow cuts and fast passes cause shock. When precision grinding with metal bonded wheels, the diamond particles become dull very rapidly, and when this occurs, grinding pressure develops and the diamond particles become imbedded in the matrix. Soon the wheels stop cutting due to glazing.

When we use resinoid bonded wheels, the danger is not glazing. Actually, the particles pull out of the matrix due to tension and the ripping action of the wheel against the weak holding power of the resin bond.

To save time in the setup of grinding chip breakers, we altered the design, figure 3, making the chip breaker parallel to the side rake angle, or at 6°. At the same time, we also changed our method of carbide removal, instead of removing carbide at .001 in. per pass, using a feed at 2½ feet per minute. We now use a plunge cut method which can best be compared with a conventional milling operation. If the speed and feed of a given mill is brought in relation to the number of teeth on the cutter, satisfactory stock removal will result. If the feed is excessive, the teeth will break.

SAVINGS THROUGH USE OF PLUNGE GRINDING METHOD

	OLD METHOD	NEW METHOD	SAVINGS
WHEEL WEAR COST	2.3c	1.8c	.5c
GRINDING TIME COST @ $6.00 PER HOUR	15c	10c	5c
TOTAL	17.3c	11.8c	5.5c per grind

The particles of diamond in the grinding wheel perform the same function as the teeth of a milling cutter. If the feed is so regulated that each particle can perform its stock removal function without tension, diamonds will not pull out.

The depth of cut then becomes secondary, as long as the feed is slow enough. No strain will destroy the diamond wheel nor damage the carbide. Feed through the work at a pace just below where the wheel can be heard laboring. The wheel should never be forced through the work.

An abundant flow of coolant must at all times be directed on the wheel and the work. The accepted feed is one second per inch per .001 in. depth of cut. For instance: a chip breaker .010 in. deep 1 in. long will take 10 seconds. A chip breaker .010 in. deep ½ in. long will take 5 seconds.

This method can be applied on all types of grinding, with only one limitation—it must be done under an abundant coolant. Chip breakers can be ground in one pass, **no matter what the depth.**

As a result of this change in method, we now grind a chip breaker in a little less than one minute, which is a saving of one-half minute per piece, plus the saving of a setup. The cost, figure 4, of diamond wheel wear is approximately 18 cents now as compared with 23 cents per piece before. This may not seem like a great saving if you take the saving of one piece which is a setup, plus one-half a minute grinding time and 5 cents wheel saving per piece. ● ●

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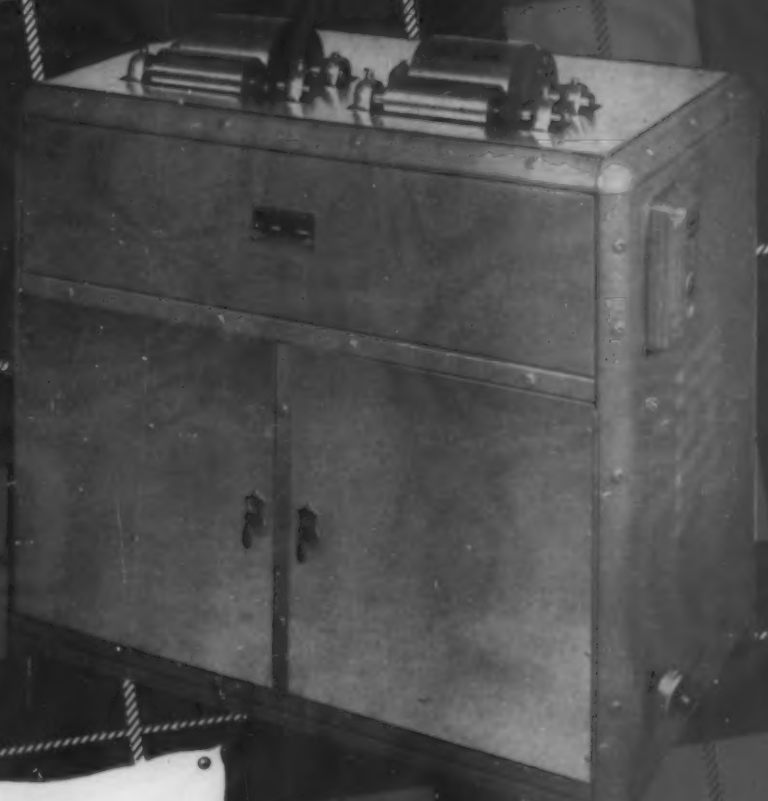

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For your further guidance, check these reasons why Norton diamond wheels are the recognized "Crown Jewels" of the entire field:

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The sizing, grading and laboratory checking of diamonds used in Norton diamond wheels is done in Norton's own plant — never anywhere else.

Norton duplicates specifications for each wheel type and size with utmost accuracy for uniform top performance.

The line of Norton diamond wheels is complete, with sizes and types covering not only every carbide grinding application but every other field — stone, glass, ceramics, electronics, etc. — where diamond wheels are used.

Norton diamond wheels for every need are quickly available from full stocks in Worcester, five strategically located warehouses and Distributor's stocks.

See your Norton distributor for further facts on Norton diamond wheel performance and applications. Ask him for the 142-page illustrated booklet, *Grinding Carbide Tools*, and the complete net priced Diamond Wheel Catalog. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Inc., Worcester 6, Mass.

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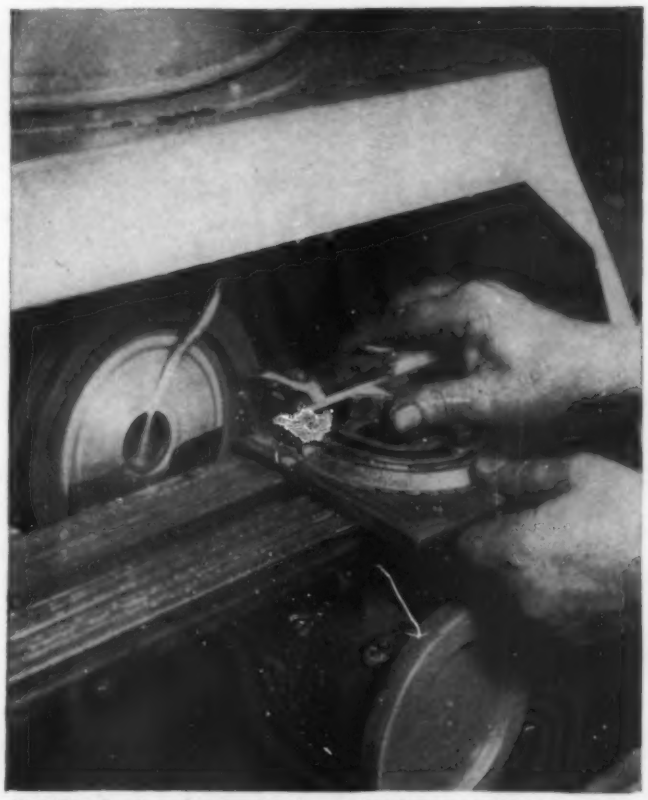
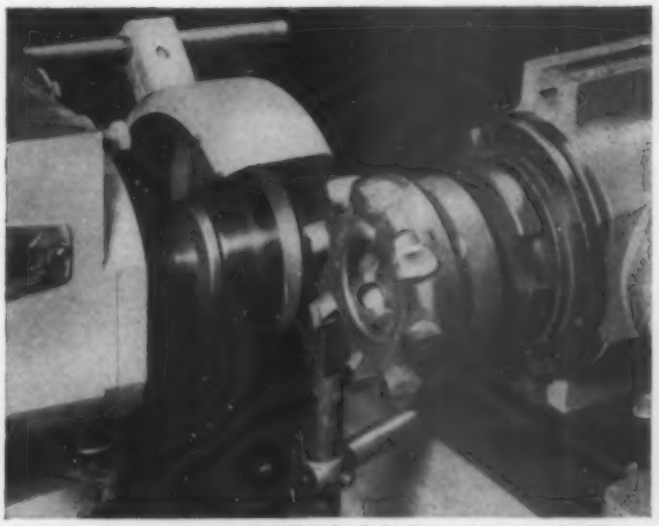
Norton Diamond Wheels...

for carbide grinding

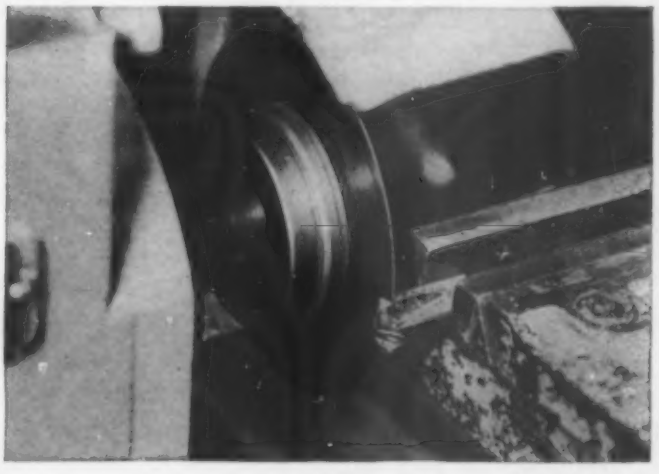


For Top Savings In Production Grinding of single point carbide tools, use Norton vitrified bonded diamond wheels. Combining fast cutting action with high resistance to grooving, they're often preferred for grinding chip breakers and for precision grinding (cylindrical, surface and internal) of carbide tools, cutters, thread gages, rolls, etc. This Norton engineered bond holds each diamond particle for maximum useful cutting action and long, money-saving wheel life.

For Top Savings On Especially Severe Single Point Tool Grinding and where long life is most important, Norton metal bond diamond wheels are recommended. They're also most economical for many other jobs — such as cutting-off sintered carbide blanks, glass, ceramics, germanium and stone.



For Top Savings In Multi-Tooth Grinding, Norton resinoid bonded diamond wheels hold size completely around cutter after cutter, assuring uniform height to each individual cutter tooth. Their extra fast cutting action and long service life are big advantages in precision sharpening. Two bond types available — regular, for maximum economy in wet grinding and B6, for best results in dry applications.



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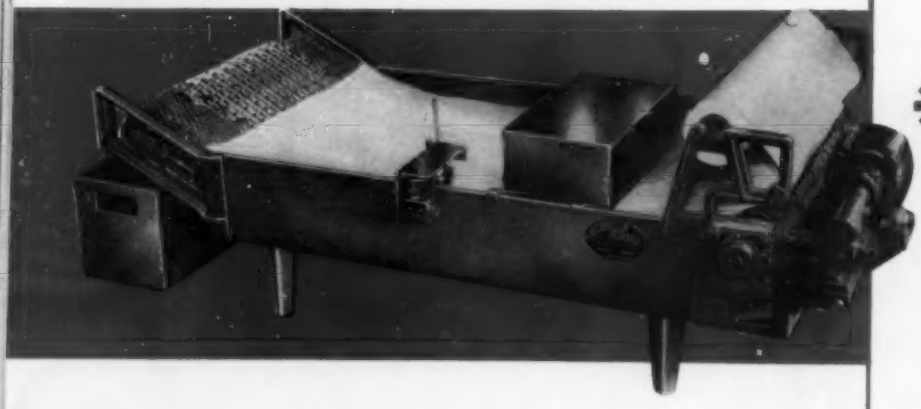

* Based on $1754.55 per filter savings shown in the 4-page brochure illustrated below

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INDUSTRIAL FILTRATION COMPANY, 76 INDUSTRIAL AVENUE, LEBANON, INDIANA

Shop Hints and Short Cuts

Diamond Wheel Dresser Can be Built Into Regular Surface Grinder

By **Tom Brown,** Consulting Tool Engineer

THE EXCESSIVE time and trouble involved in wheel dressing on surface grinders is made up of adjusting the wheel height to suit the diamond and the adjustment needed to make contact once more between the work and the wheel. Another disadvantage of the simple block-mounted wheel dresser is that the expensive dressing diamond is used incorrectly and has a very short life.

A dressing diamond should slope in relation to the wheel surface which it is dressing; the dressing tool shank should be arranged so that the diamond is trailing behind it while removing grit from the wheel. Another way in which dressing diamonds are abused is the neglect of diamond rotation. Even a diamond will wear off so that it becomes blunt and unfit for a wheel dressing. The cutting properties can be renewed continuously if the diamond holder is rotated through part of a turn each time it takes a cut across the grinding wheel surface.

Built-in Dresser

Illustrated is a dresser, designed by the author, for building into a plain surface grinder. The dresser is always positioned over the wheel axis and does not require bringing into position in order to be used. The diamond tool shank **A** is fixed at an angle to the grinding wheel edge and the point **B** trails behind the shank during the dressing cut. The diamond is turned each time a cut is taken over the wheel. Each time the dresser takes a cut, it feeds downward through .001 in. The advantage of this is that the operator knows exactly how much the grinding wheel radius has been reduced during each dressing cut. For example, if the dresser takes two cuts over the wheel

- ✓ dresser is always positioned over the wheel axis
- ✓ does not require bringing into position to use
- ✓ diamond is fixed at an angle to the grinding wheel edge
- ✓ diamond is turned each time cut is taken
- ✓ each time dresser takes cut, it feeds downward through .001 in.
- ✓ operator knows exactly how much grinding wheel radius has been reduced during dressing cut

edge, .002 in. will have been removed from it. The new wheel edge will then be .002 in. clear of the work surface and the wheel head can then be fed downward through this distance to renew contact with the work surface.

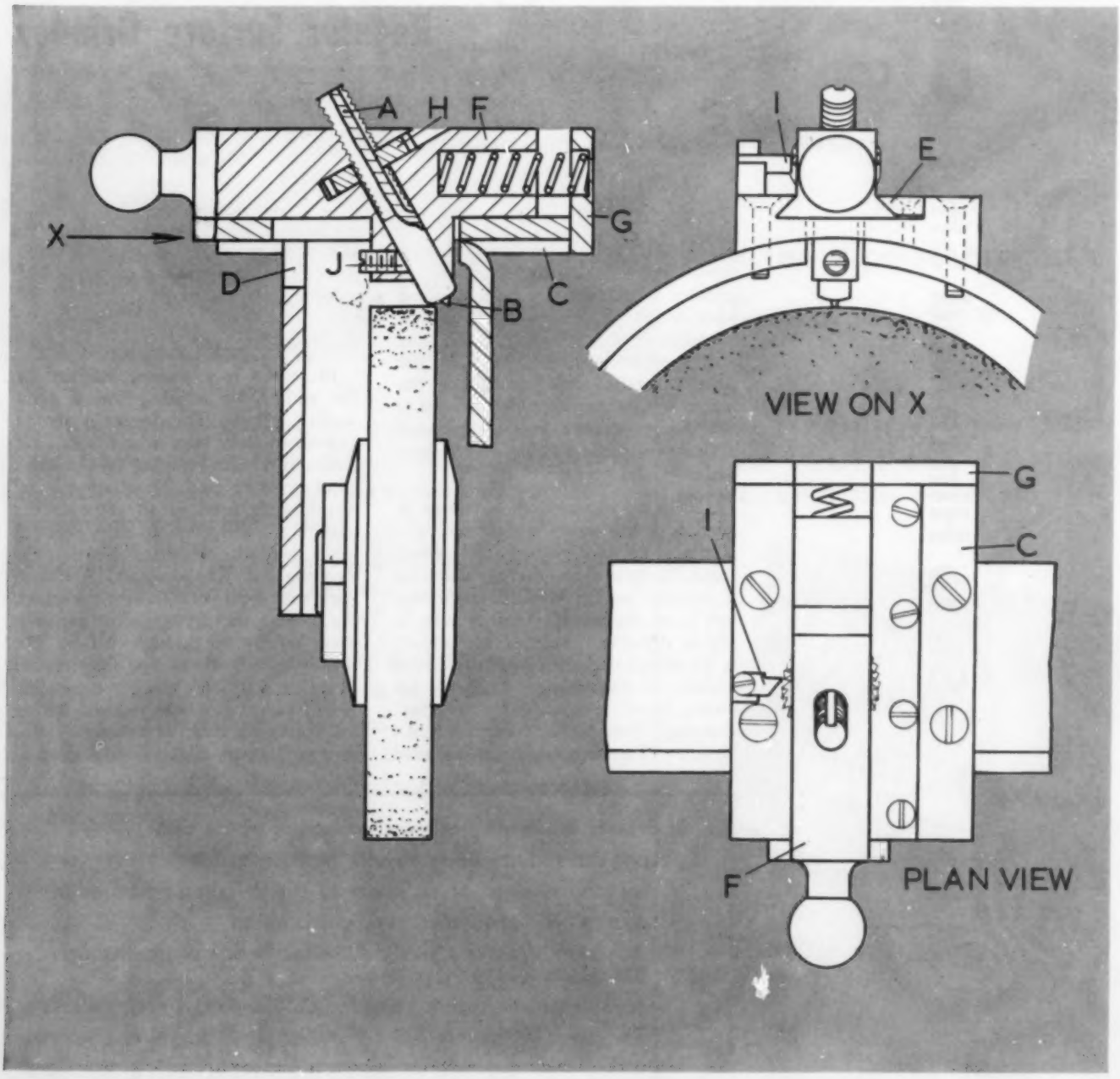
The dressing device comprises a base block **C** which is radiused on its underside for location on the outside of the circular wheel housing. The housing casting must be modified by cutting in it a slit **D** which will allow the diamond holder to project downward and make contact with the wheel periphery. Incorporated in the base block is a dovetail section slide-way with an adjustable gib strip **E** for taking up sliding clearance.

The diamond holder **F** slides horizontally in the base block which is made from one solid piece of metal with a knob machined on one end. At the other end is housed a compression spring with one end abutting against a stop plate **G** secured to the end of the base block. When not in use, the diamond holder is always projecting outward from the front of the wheel head.

The dressing diamond is of a standard type incorporated in the end of a circular steel shank. The diamond must have been mounted symmetrically in the end of the shank, in line with shank axis. This is a standard practice adopted by diamond tool makers. The shank is threaded externally for part of its length and the thread engages with a tapped hole in the diamond holder. An angular slit is milled across the holder and houses within it the ratchet wheel **H.** The tongue of metal above the slit contains the threaded hole while the rest of it below the slit is plain and forms a bearing for the diamond tool shank.

A keyway is milled longitudinally along part of the diamond tool shank for engagement with a key, integral with the ratchet wheel bore. This is an awkward item to machine, but it can be made much more easily by making the key separate and silver soldering it to the ratchet wheel bore.

From the foregoing, the ratchet wheel rotates the shank of the dressing diamond which also moves axially as it rotates and thus feeds down to the wheel periphery. A dressing cycle comprises pushing the knob end of the diamond holder inward as far as possible and then relaxing the pressure so that the holder slides back slowly under the action of the compression spring. Dressing takes place during this return stroke and the diamond is advanced by the ratchet wheel making contact with a swinging pawl **I.** The wheel makes a partial



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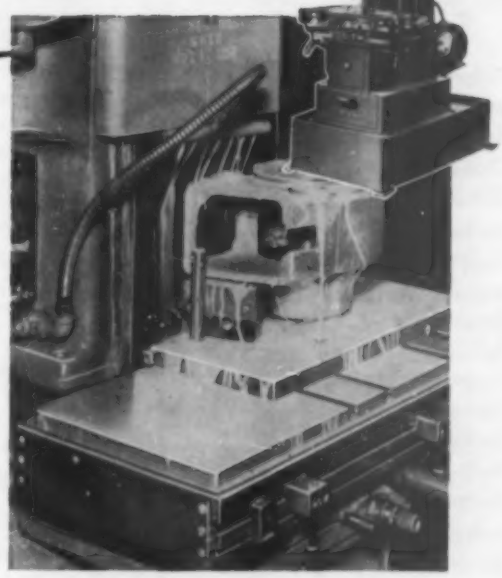

Features high speed cutting by millions of abrasive points imbedded in a continuous belt, cooled and cleaned by water and other coolants. Does close tolerance work on flats, squaring, cylindrical surfacing; deburrs, knocks off corners, forms radii, bevels and other operations. Often does milling, shaping, grinding operations 10 times faster — saves 75-90% set-up time.

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turn, rotating the shank which feeds downward through .001 in. through the medium of its threaded exterior.

Contact between the ratchet wheel teeth and the pawl is encouraged by making the teeth at an angle to the wheel axis, something like a spiral gear tooth, to ensure that the one tooth in contact with the pawl is vertically placed. The pawl swivels on a vertical pin and has a light spring return (not shown).

Maximum support for the diamond tool shank is afforded by projecting the holder downward through an elongated slot in the base; the plain lower portion of the shank is enclosed and prevented from vibrating by the solid mass of metal enclosing it.

To further damp out vibration and to hold the shank positively against the effects of turning originating from vibration, a very simple resilient clamp is fitted. This comprises a short slug of soft fiber J which presses against the lower part of the shank. The fiber is backed up by a screw which can be tightened sufficiently to hold the shank at its indexed position. The slug allows, however, the shank to be rotated under the action of the ratchet wheel and pawl.

The thread pitch and the number of teeth in the ratchet wheel must be arranged so that the down feed of the diamond point is .001 in. vertically. In the example shown, a thread pitch of 40 tpi and a ratchet wheel of 22 teeth gave a vertical down feed to the diamond of .00981 in. This is about two-tenths of a thousand less than required, but since the wheel is not cut perfectly by the diamond, this two-tenths error is not objectionable. Of course, a special thread pitch can be used to give the exact down feed needed to dress .001 in. off the wheel at each traverse of the diamond. In the example, the diamond tool shank is placed at an angle of 30 degrees to the vertical so it must travel axially through a distance of .00154 in. to reduce the grinding wheel radius by .001 in. ••

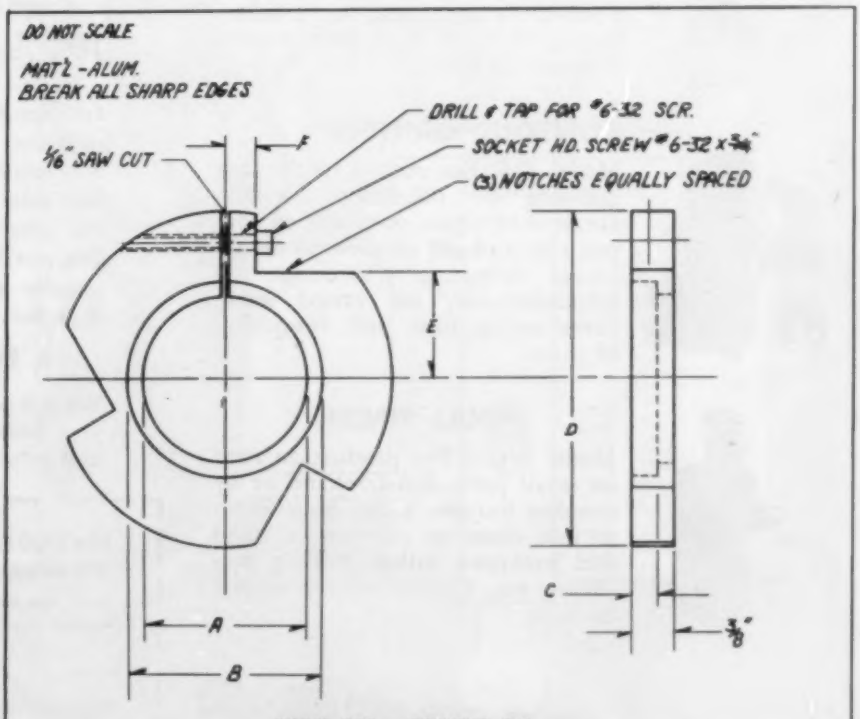
A Drive Dog Problem Solved

By **Harold R. Rhodenbaugh**

Getting the correct drive dog on the job at the proper time often presents a problem in experimental or small production shops where job lot quantities are small and delivery dates are urgent.

Figure No. 1 shows a method of standardizing O.D. grinder drive dogs for grinding small gear bearings and bump grinding faces. A maximum O.D. is established for the dog. The profile is formed into blanks which are produced or purchased in quantity and stocked under a T-number. Quantity production reduces cost.

Only a few minutes lead time is required to bore and counterbore the blank into the finished product. ••



DRIVE DOG - GRINDER O.D.

TOOL NO	A	B	C	D	E	F
BT-34877-01	3/4"	1.1321.001	.3/32"	2.000	5/8"	1/4"
BT-34877-02	5/8"	1.087/1.086	.050	2.000	5/8	1/4
BT-34877-03	5/8"	.623-.624	.078	2.000	5/8	1/4

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keeps honing operations always at peak efficiency because it automatically compensates for stone wear. With electronic hone expansion control, you can select any degree of finish you require, through proper rate of feed, grit, grade and bond of abrasive stone.

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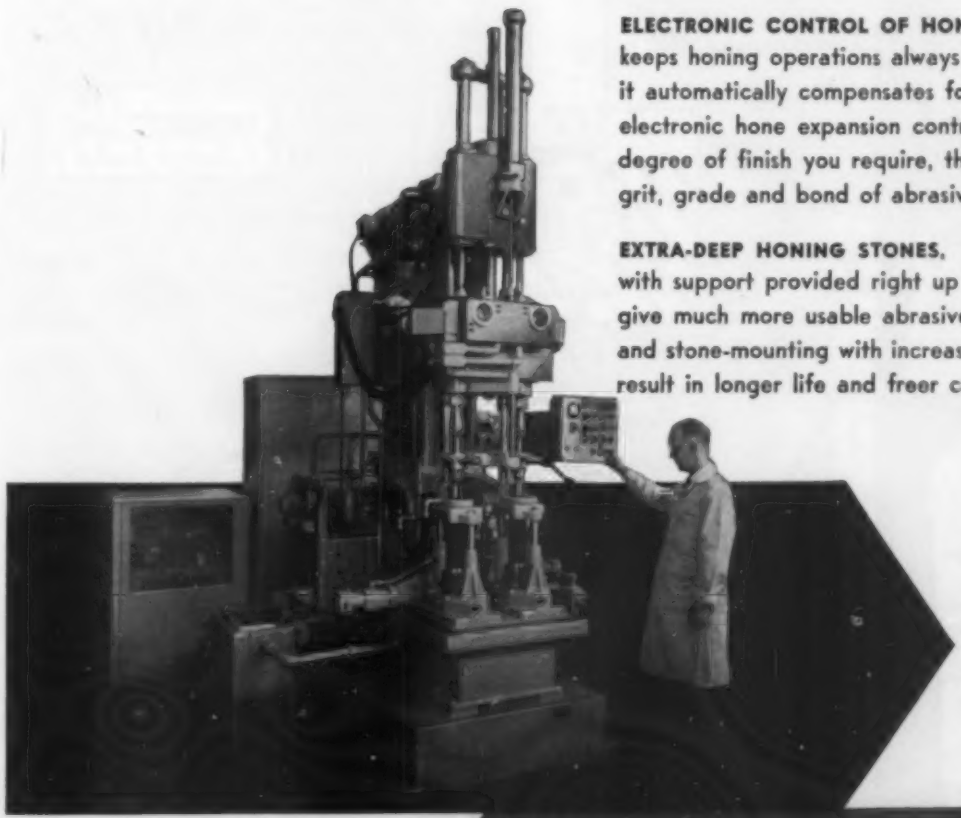
with support provided right up to the cutting edge, give much more usable abrasive. Improved body design and stone-mounting with increased cutting edge support, result in longer life and freer cutting action.



No. 307
VERTICAL HONING MACHINE
Job Specifications:
Steel Hydraulic Cylinders
Bore — 3.000" I.D. x 10⅓" length
.012"/.017" stock removed
Bore Sizing — within .0005"
Finish — 25 R.M.S.
34 pieces per hour

No. 38
HORIZONTAL HONING MACHINE
Job Specifications:
Steel Tubes
Bore — 1.500" I.D. x 10 ft. length
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Bore Sizing — within .0005"

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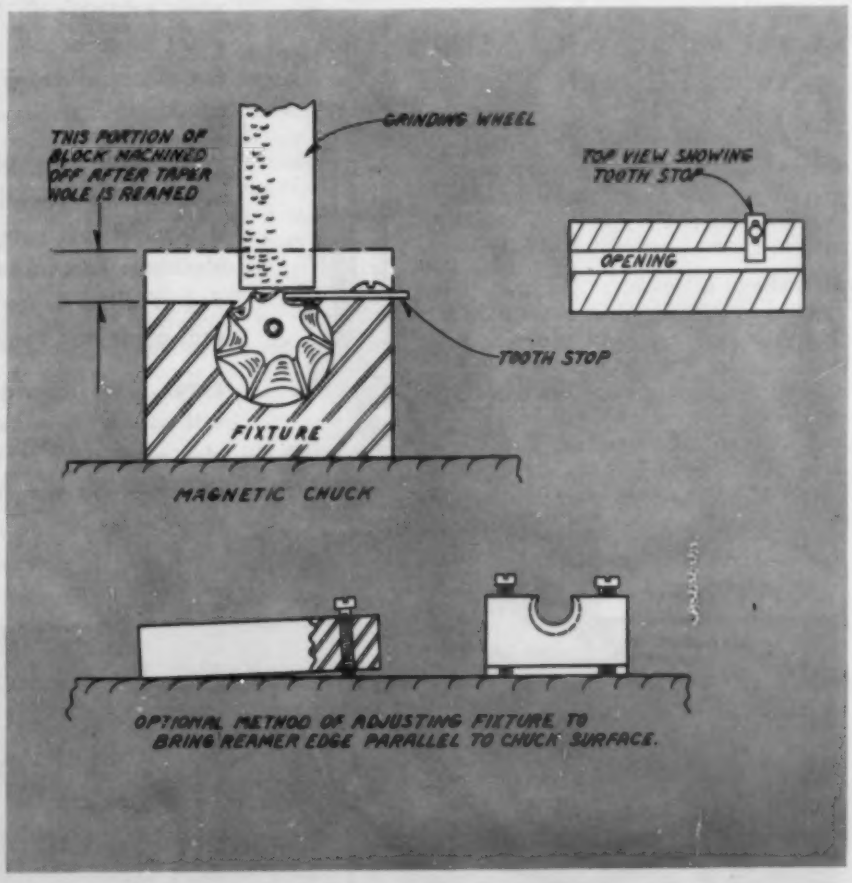
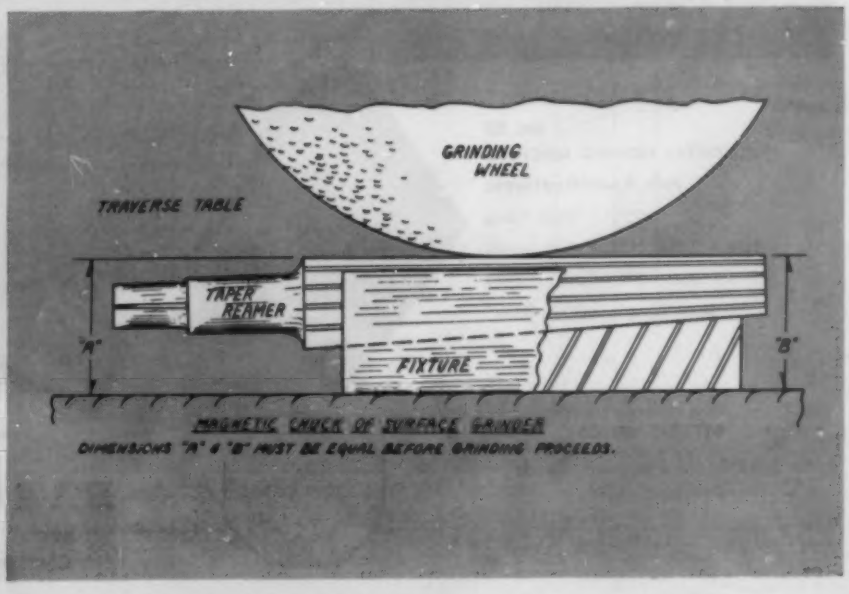
Simple Fixture For Re-Grinding Taper Reamers on a Surface Grinder

By **H. J. Gerber**

Sometimes when reamers are ground they often have a serrated cutting edge due to the rotation of the wheel at right angles to the cutting edge. It is also quite a problem to adjust the cutter grinder for the correct amount of TPF. This simple fixture is permanently set for the correct angle of taper and is used in such a fashion as to have the passage of the grinding wheel in a direction parallel to the cutting edge of the reamer.

The fixture is simple: Secure a piece of rectangular mild steel or cast iron. Drill into it lengthwise a hole of proper size and ream this hole with the taper reamer which is to be re-ground. Next machine off the top of this block far


THIS PORTION OF BLOCK MACHINED OFF AFTER TAPER HOLE IS REAMED
GRINDING WHEEL
TOP VIEW SHOWING TOOTH STOP
OPENING
TOOTH STOP
FIXTURE
MAGNETIC CHUCK
OPTIONAL METHOD OF ADJUSTING FIXTURE TO BRING REAMER EDGE PARALLEL TO CHUCK SURFACE.



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2. **POINTS** are high speed steel, designed to make rigid, positive contact with workpiece.
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6. **LUBRICANT** sealed-in-for-life with special bearing filtered grease.
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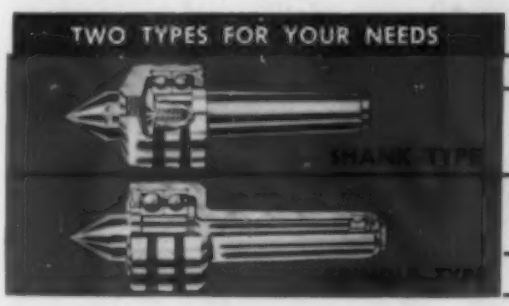

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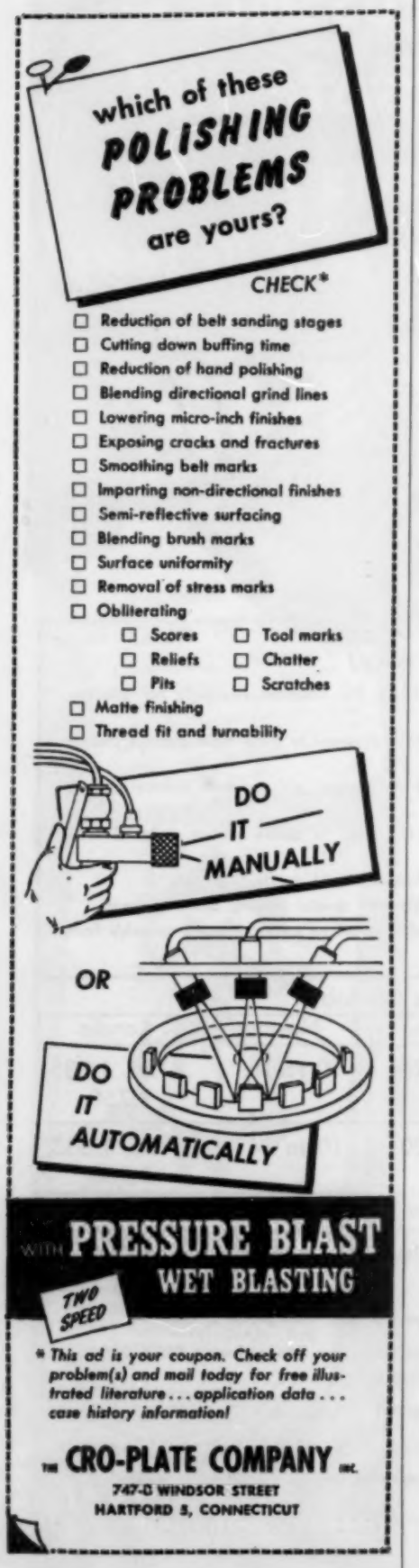

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enough to expose the uppermost cutting edge of the reamer. The bottom surface of the block is then machined off at the proper angle to bring the land of the reamer parallel to this base surface. The block should be set up on a surface plate, with a reamer tightly inserted in the hole, and a dial indicator test made along the land to prove the above condition. Another method for accomplishing this same result is to make use of two "jacking" screws threaded into one end of the block. These screws can then be adjusted to lift the end of the block up until the reamer land tests parallel.

A tooth rest indexing stop is made from spring steel and secured to the top of the block, as shown. This tooth rest is adjusted to the face of the top tooth and locked in this position. The hole for the screw which secures the tooth rest should be elongated so that it may be adjusted to change the relief angle of the reamer cutting edge. When once set it can be locked in place for succeeding teeth.

The fixture is placed on the magnetic chuck of the surface grinder and each tooth is then ground after indexing to the tooth rest.

In addition to producing a superior cutting edge, the operation of grinding is very rapid and relatively foolproof, once the proper relief angle has been established. • •

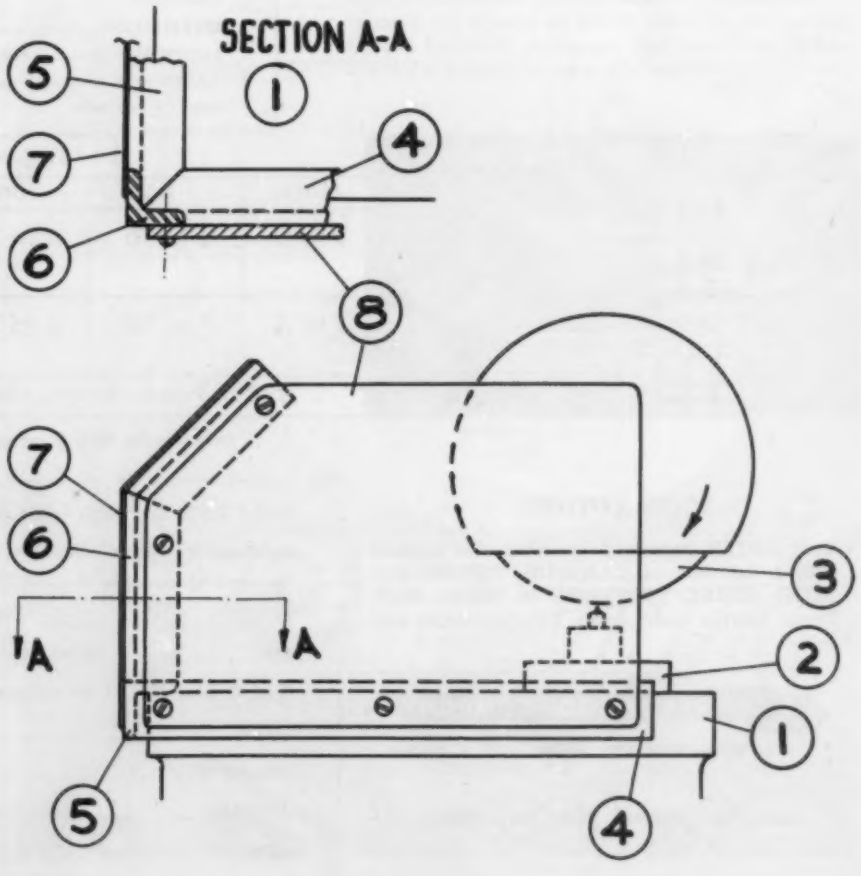
Plastic Guard Protects Operator

By **William Bradner**

When diamond dressing the wheels of dry surface grinders, the dislodged particles of the wheel usually prove to be a great nuisance to the operator as well as a safety hazard as they travel through the air with great speed. Even the suction system is usually unable to cope with this condition. To eliminate this hazard and to protect other nearby located precision machinery, a guard was designed as shown here:

The grinding wheel 3 is being dressed by diamond dresser 2 which is placed onto the magnetic chuck surface 1. Two steel angles 4 and 5 are welded together as shown in section A-A. An upright angle 6 that is bent near its top is then welded to the other angles. A sheet metal cover plate 7 is bent to match angle 6 and is welded to angles 6 and 5. The front of the guard 8 is clear acrylic plastic (known under trade names as Plexiglass or Lucite). Clearance holes are drilled through the plastic sheet and screws serve to fasten it to angles 6 and 4 which are drilled and tapped to match the holes of the plastic sheet. Or, if desired, the screws could go through clearance holes in the angles and nuts can be used for securing the plastic sheet to the angles.

Acrylic plastics can be drilled, sawed



and sanded with some care, and instructions for this work can be obtained readily from the vendor of the plastic.

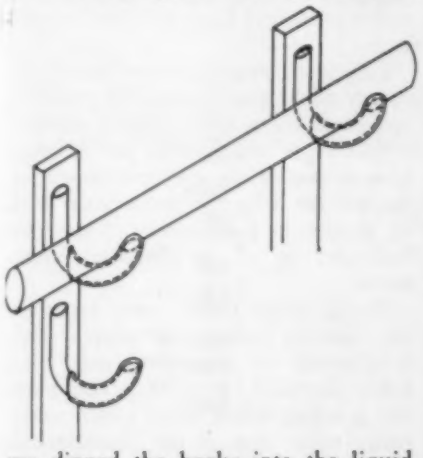
This shield is a good and practical protector as its clear front will enable the operator to observe his work without the connected dangers. Since it is merely placed onto the magnetic chuck, the setup and the removal of the guard is but a matter of seconds. • •

Protected Storage Hooks for Highly Finished Bars

By **Gregory Nichols**

When it was necessary to store a number of highly finished, ground bars before and after finishing operations, we were quite concerned about accidental nicking or scratching of these bars.

In order to store these bars safely, we devised a simple rack by welding hooks, made of ½ in. diameter round stock to vertical flat bars which were then fastened to the wall or to the backs of other storage racks. To protect the bars from being scratched by the hooks,



we dipped the hooks into the liquid plastic that is now used almost universally for the protection of finish-ground cutting tools. After the liquid plastic hardened, it formed a safe protecting coat over the steel hooks.

Another practical way of doing the same thing is by slipping suitable lengths of rubber garden hose over the hooks. • •

Simple Fixturing Eliminates Vise Set-Ups

By **Robert Miller**

Savings in setup time and elimination of "first-piece-scrap" often pay for simple fixturing for many surface grinder operations.

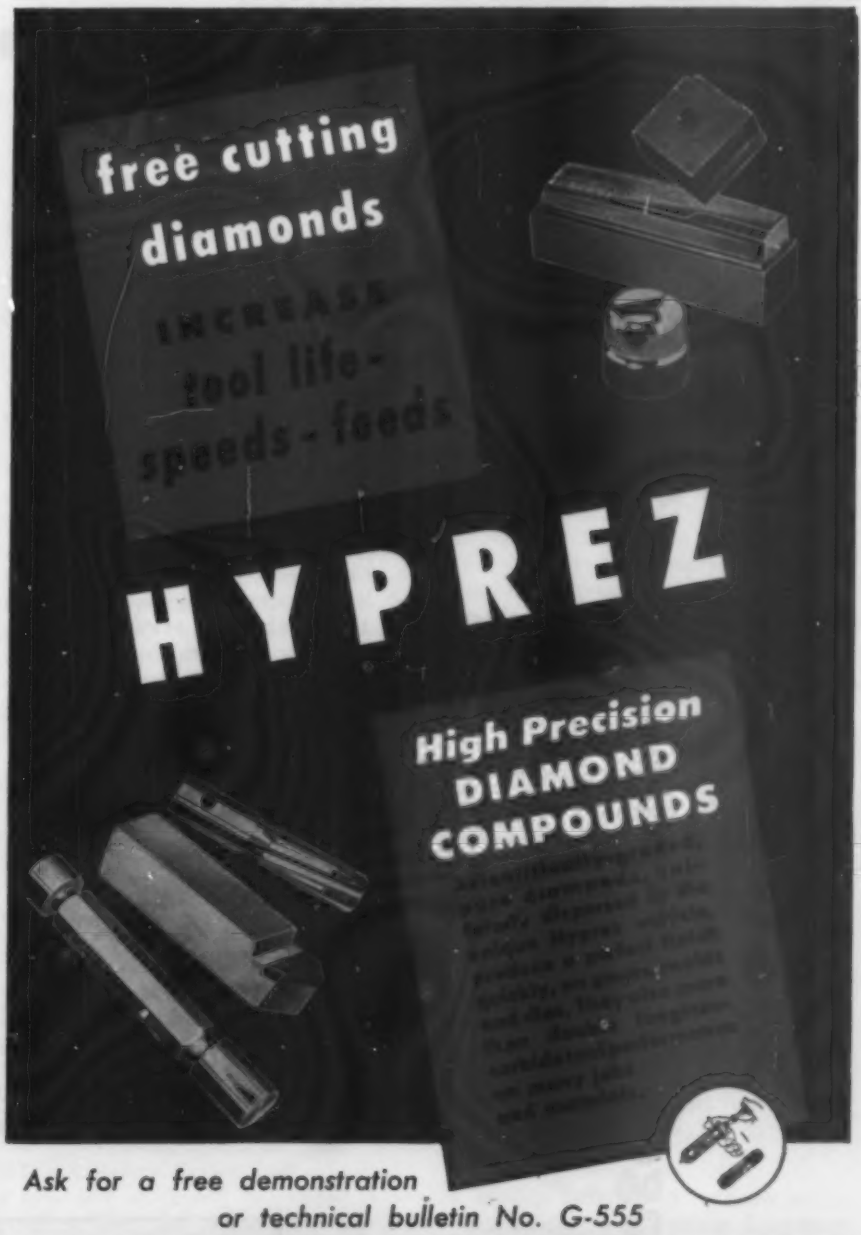
Just one such example is shown here where a surface grinder is used to sharpen the cutting edges of a facing blade for a slot-type boring bar.

The fixture is a slotted block, made on a shaper in but three hours' work. Three tapped holes accommodate the screws that hold the cutter blade tight. The correct cutting angle is built into the fixture.

Fixture edge is placed flush (or parallel) with the edge of the magnetic chuck.

Proper cutting angle of facing blades is built into fixture. Long clamping screws aid operator in keeping his fingers away from spinning wheel.

Since the setup of this fixture entails only its being placed onto the magnetic chuck so that its edge is parallel with the table, the savings in setup time over the use of the customary angle vise soon added up to a considerable amount. • •



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Pages from Ronnie Burritt's Notebook

Also Use Your Centerless Profiling Attachment For Thru-Feed

I've been using my Cincinnati centerless profiling attachment on thru-feed work for many years and have had marvelous results. Some of us are always in such a hurry and time is so short that we do jobs as we've done them for years, forgetting that machine builders and wheel makers have spent a lot of time and money perfecting their products in order to save our time.

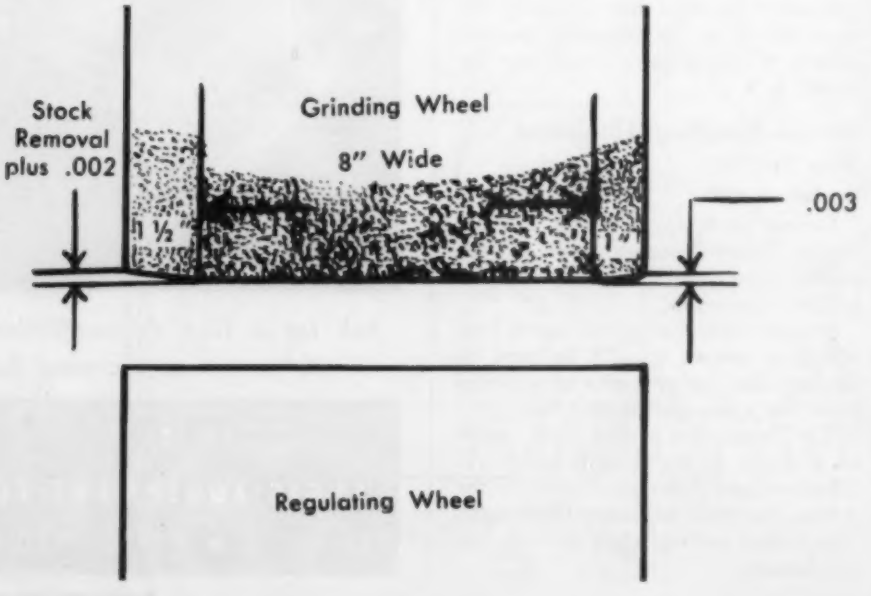
As you know, when you feed a part into a centerless the wheel will break down and taper the lead-in edge. The wheel, after all, is like a human being, it shapes itself according to the force of least resistance; consequently you get this break-down, or taper. So why not dress the wheel to that shape right off the bat? With this taper ground at the lead-in edge a much finer finish is obtained on the 5½ inches of the grinding periphery of the wheel.

By looking at the sketch you will see, when I dress the wheel for the taper that I take off the amount of stock to be removed from the part plus .002 inches. (If I'm going to remove .010 inches of stock, I taper in a total of .012 inches.)

Having this taper you get immediate control of the part because the grinding surface is more than a point contact.

You'll get more pieces per dressing because you've already conditioned, or shaped, the wheel in accordance with its maximum performance. I use this lead-taper on all my thru-feed operations.

You'll notice I also use a taper on the lead-out end of the wheel. This is primarily for interrupted cuts, cross holes, keyways, etc. This eliminates the grinding wheel nicks which sometimes occur due to the characteristic of the part. With this end taper you'll also eliminate the tail-end spinning of the part as it shoots out of the machine. Both tapers have been very successful in my plant.



Available Literature

Catalogs and Bulletins Available from Manufacturers

For copies of the literature in which you have an interest use the postage-paid postcard. Merely circle the identifying number and mail the postcard.

1. Surface Grinders. Type CX hydraulic surface grinders, for heavy duty production, are described in complete detail in a colorful catalog, CX54, issued by the Thompson Grinder Co., Dept. GF, Springfield, Ohio. Massively built with heavy base and single column design, the grinders are claimed to provide rapid removal of stock while maintaining close limits of accuracy and fine finish. An illustrated list of auxiliary equipment is also included in the brochure.

2. Precision Cleaning and Finishing. Dealing with the Liquamatte wet blasting process, Bulletin No. 541-D, published by American Wheelabrator & Equipment Corp., 1172 S. Byrkit St., Mishawaka, Ind., presents 40 frequently-met applications in which this process can be used. A description of the process itself, in which water-suspended abrasives are thrown at high velocity upon the work, is also included, together with the necessary equipment, and the fact that tolerances of .0001" can be maintained.

3. Disc Grinders. Bulletin 200, detailing a new line of double horizontal disc grinders, has been issued by Besly-Welles Corp., 122 Dearborn Ave., Beloit, Wis. The well-illustrated catalog contains application and construction information on the company's double horizontal disc grinders in sizes ranging from 3 to 50 hp, which use disc wheels ranging from 12 to 72-inches in diameter. Work feed fixtures for use with these grinders, specific applications, and performance data are also presented.

4. Honing Machines. Catalog 1154, describing various models of honing machines, a new portable coolant unit, mandrel driver, and honing head, is available from Superior Hone Corp., 1616 Elreno St., Elkhart, Ind. Catalog also provides helpful data on honing: what a honing stone is, selection of the proper mandrels and stones, blind hole honing, etc.

5. Chaser Sharpening Machine. Designed to eliminate tying up heavy expensive machine tools needed for other operations, the Jones & Lamson Machine Co., Die Head Div., 522 Clinton St., Springfield, Vt., has developed a universal bench type chaser sharpening machine, which is claimed to have universal application, repetitive accuracy, ease and economy of operation. A bench space of 14x28 inches is ample for complete chaser resharpening operation. Catalog No. 503-A available from company.

6. Surface Grinders. A brochure giving recommended uses, features of construction, specifications, and other information on their line of surface grinders, is available from Abrasive Machine Tool Co., 14 Dunellen Rd., East Providence 14, R. I. Each machine has the same rigid, one-piece bed with heavy ribs and strongly reinforced openings,

and a unit system of construction which permits easy access to parts for adjustment or repair.

7. Polishing-Grinder-Dust Collectors. Bulletin No. 1455, Leiman Bros., Inc., Dept. GF, 102 Christie St., Newark 5, N. J., illustrates and describes the latest line of Leiman polisher-grinder-dust collectors for light metal, jewelry, silverware and dental work. These compact, high-suction machines have a built-in triple filtering dust collecting system which requires no auxiliary equipment. Both light and heavy-duty models and a new sit-down model are included in the bulletin.

8. "Barrel Finishing." A new booklet describing barrel finishing techniques and products has been published by Minnesota Mining & Mfg. Co., Dept. A-1632, 900 Fauquier St., St. Paul 6, Minn. It explains how the process works, what types of parts can be finished, and what operations barrel finishing performs. It also contains an illustrated case history section, lists the complete line of "Honite" chips, compounds and equipment, and features step-by-step pictures of barrel finishing operations.

9. Mineral Shot. A technical bulletin published by Baldwin-Hill Co., Dept. GF, 500 Breunig Ave., Trenton, N. J., describes the characteristics and performance of the company's new non-metallic, dustless Mono-Kleen mineral shot for blast cleaning. Before-and-after photographs show the performance of this non-conductive, non-corrosive cleaning material in blast cleaning a number of typical castings.

10. Grinding Wheels. A folder describing their complete line of Aircore grinding wheels is available from Nu-Matic Grinders, Inc., Dept. GW, 8224 Carnegie Ave., Cleveland 3, Ohio. The Nu-Matic wheel is fabricated like a tubeless tire. While it is in a deflated condition, the operator fits an abrasive band over the outer surface and then slightly inflates the wheel to pressures best suited to the required operation.

11. Bench Grinders, etc. Poly Products Co., Dept. G, 230 E. Pomona Ave., Monrovia, Calif., has issued a catalog describing their complete line of bench grinders, arbors and sanding discs. Feature of the line is the ball-bearing mandrel construction of all Poly grinders and arbors. All products are catalogued and illustrated.

12. Lapping, Honing, Grinding Service. Suggestions for the solution of problems inherent in the production of accurate surface finishing are offered in a brochure available from Surface Finishes, Inc., 139 Official Rd., Addison, Ill. Various phases of exacting micro-inch finishes, parallelism held to two millionths of an inch, and high precision in roundness, flatness, straightness in external, internal and flat surfaces are mentioned in the brochure.

13. Grinding Wheel Dressers. L. Newman, Dept. GL, 1001 24th St., Oakland 7, Calif., has available a leaflet describing their various models of grinding wheel dressers. Includes models designed for the surface grinder with or without a magnetic chuck, for dressing and truing the grinding wheels on cylindrical grinders; hand type dressers for use on bench or pedestal grinders; heavy-duty dressers suitable for foundry and heavy grinding, and a universal model.

14. Coolant Filters. Two folders, one describing Delpark coolant filters for use on Cincinnati precision grinding machines and illustrating various Cincinnati grinders and the Delpark model required for each. The other on the savings realized at Continental Motors by the use of these filters, are available from Industrial Filtration Co., Dept. GF, Lebanon, Ind. Folders explain how the Delpark filter operates and give several illustrations of the filters in operation.

15. Disc Grinders. Rankin Bros. Eng. & Sales, Inc., Dept. G, 11104 S. Alameda St., Lynwood, Calif., has issued a booklet on their new Apex Model S disc grinder which features a reversible disc, wrap-over tilt-back guard, permanent lubrication, and counterbalanced table. The grinder is described from top to base. A few of its applications and other models and accessories are also shown.

Brand New!

haskins

haskAIR Grinder...

most powerful air turbine grinder in its class!

75,000 R.P.M.

(1/5 H.P. prony brake test)

- **Permanently sealed bearings . . . never needs lubrication in air lines or grinder.**
- **Removable nose piece for deep grinding.**
- **Gyro action of turbine holds tool steady.**

Here's power—SUSTAINED POWER—like you've never experienced before in an air grinder . . . power unexceeded by any other air grinder in the same price range . . . maintains its high-speed efficiency under load! Built with a lightweight, contoured, hand-fitting aluminum housing, the Haskins haskAIR Grinder handles easily, balances perfectly . . . excellent for the most precise grinding job. Complete kit includes: carrying case, adapter hose, mounted points, dressing stone and wrenches.

for Complete details WRITE

haskins

HASK-AIR HASK-FLEX

2649 W. Harrison St.
Chicago 12, Illinois

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16. Centerless Lapping Machines. Precision lapping by the centerless method and the line of centerless lapping machines built by the Size Control Co., 2502 W. Washington Blvd., Chicago 12, Ill., are described in a folder available from the company. Claimed to provide finishes of 1½ microinches or less and tolerances of .000005, the machines are used for the lapping of oversize gages, lapping worn gage plugs to next lowest size, and lapping bearings, bushings, shafts, or contoured pieces.

17. Tap Saver. A flyer issued by the Vulcan Machine Co., Dept. GL, Waynesboro, Pa., illustrates and describes their radial relief tap saver and cutter grinding fixture. Designed primarily for grinding taps the Vulcan tap saver is also useful in making and reclaiming many other types of tools.

18. Surface Finish Control. A booklet describing how surface finish control can reduce machining costs, help increase production capacity and help improve a product, has been issued by the Brush Electronics Co., Dept. GP, 3405 Perkins Ave., Cleveland 14, Ohio. The Surfindicator, a shop tool for measuring surface roughness in production and inspection, is also described and illustrated.

19. Abrasive Grain & Powders. Booklet No. 14, issued by the Carborundum Co., Dept. GF, Niagara Falls, N. Y., contains specifications and recommendations to help identify, select and use abrasive grain and powders for metal finishing operations. Topics include a section on metal polishing: types and properties of polishing abrasives; suggested layout for set-up room and curing room, etc. Booklet also includes sections on metal buffing, metal tumbling and pressure blasting.

20. Rotoblast Unit. Pangborn Corp., Dept. G, Hagerstown, Md., manufacturer of blast cleaning and dust control equipment, has published Bulletin No. 227 describing the type RG Rotoblast unit used in the company's blast cleaning machines. The Rotoblast system uses the principle of controlled centrifugal force for its blasting power, and the unit provides an extremely high concentration of abrasive applied with great striking force and is used on the various types of blast cleaning machines manufactured by Pangborn.

21. Barrel Finishing. The Mity-Mite line of precision barrel finishing units is described in a folder available from the Miller Machine Tool & Gauge Co., Dept. GF, 3613 San Fernando Rd., Glendale 4, Calif. Included are the Mity-Mite "Stubby" a 36″ double roll unit, the "Long Tom" a 78″ single roll unit, and the Mity-Mite "Junior" for small parts, small lots, short runs and sample parts, and a hot sawdust drying, polishing and waxing barrel.

22. Surface Grinder. Model 2HF 6″ x 18″ hand feed surface grinder, the Gagemaster, is described in a flyer issued by the H. Leach Machinery Co., Dept. GS, 387 Charles St., Providence 4, R. I. Made in Italy, the machine is massive in construction for vibrationless precision, rigidity, balance and convenience. All handwheels centrally located at operator's level for ease of operation.

23. Gear Grinding Machines. The Gear Grinding Machine Co., 3931 Christopher, Detroit 11, Mich., has issued an 8-page brochure on their automatic gear grinding machines for gears, spline shafts, specially contoured parts. Features of the machines are illustrated and described, and data on five typical parts most commonly used by U. S. industry and five examples of unusual grinding problems is also included.

24. Grinding Wheels. A bulletin available from the Cincinnati Milling Products Div., Dept. GW, The Cincinnati Milling Machine Co., Cincinnati 9, O., contains information on their grinding wheels which offer positive duplication (PD). Included are several photographs of the (PD) wheels in action. (PD) wheels are made in all popular shapes and sizes for portable, stand and swing frame grinders in ferrous and nonferrous work.

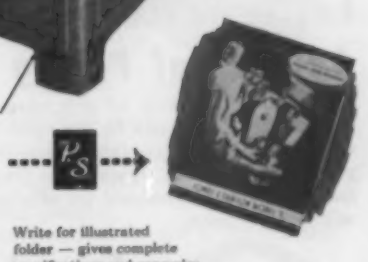
25. Coping Wheels. A circular issued by the Geo. H. Bullard Co., Inc., Dept. G, Hopkinton Rd., Westboro, Mass., gives complete information on their

An Outstanding Advance

In PLUNGE FORM GRINDING

Sets New Records for Production and Accuracy . . . Reduces Costs . . . Replaces Other Methods for Producing a Great Variety of Work! Note These Advanced, In-Built Features!

- **Completely automatic cycle** — High speed approach, wheel feed spark out and withdrawal are positively controlled through simple cam action — ensuring constant, uniform operation under all conditions.
- **Automatic positive size control** — The wheel slide is held against positive stops with uniform hydraulic pressure.
- **Automatic trueing device** with controlled dressing.
- **Automatic or manual handling.**
- **Complete versatility** — chucking work, center work or shoe-type grinding; crush wheel or diamond truing.
- **Compact design** — affords exceptional accessibility and simple set-ups.



Write for illustrated folder — gives complete specifications and examples of how the Model "E" does jobs faster, better and more economically.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 531 Clinton St., Dept. 710, Springfield, Vt., U.S.A. — MACHINE TOOL DIV.

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"Safe-Center" coping wheel which is discarded when worn out.

26. Abrasive Wheels. Specially designed for deburring, light grinding, finishing and polishing irregular surfaces, the Grind-O-Flex coated abrasive wheel consists of hundreds of "leaves" of abrasive cloth strips sealed into a core. As the wheel spins, it presents a continuous abrasive surface to the workpiece. Available with Behr-Manning Metalite cloth refills. Folder available from Merit Products, Inc., Dept. GF, 4023 Irving Place, Culver City, Calif.

27. Drilling, Fastening & Abrasive Tools. A colorful 65-page catalog, G-10, has been issued by the Buckeye Tools Corp., Dept. GT, Dayton 1, Ohio. Complete information is given on drilling, fastening and abrasive tools: drills—non-reversible, reversible angle head (heavy and standard duty), jig; screwdrivers and nutrunners—non-reversible, reversible and angle head; wrenches; grinders—collet and spindle, horizontal, turbine; horizontal grinders and buffers; vertical grinders and sanders; right angle and belt sanders; belt grinding attachments.

28. "How to Store Coated Abrasives." Armour & Co., Coated Abrasives Div., Dept. GA, Alliance, O., has issued a booklet on the proper conditions under which sandpaper should be stored to retain its efficiency and usefulness over a long period. Both the backing material and the adhesive used in sandpaper are sensitive to climatic conditions and will gain or lose moisture in accordance with the relative humidity. A brief description of the Armour abrasive line is also included in the booklet.

29. Abrasive Band Wheels. The new Even-Cut band wheel catalog pictures the three types available: round shank units for chuck mounting; wheels with threaded shanks for attachment to threaded spindles; heavy-duty aluminum insert flange models drilled for arbor mounting. Wheels are furnished in sizes from ¼" diameter by ½" width to 6" diameter by 2" width, with matching bands in aluminum oxide, silicon carbide and garnet in open, closed and spaced grain coatings in grits from 24 to 400. Catalog available from Even-Cut Abrasive Band Co., Dept. G, 8212 Carnegie Ave., Cleveland 3, Ohio.

30. Abrasive Files. Diamilite Abrasives, Inc., Dept. GF, 2301 Main St., Santa Monica, Calif., has issued a flyer on their new abrasive files which they claim will do any job from rasping to polishing by changing the slip-on grit tubes. Tubes are available separately in one inch square or round in all grit sizes, or in sets of three tubes and handle.

31. Surface Grinders. The Reid 618 surface grinder, available in four models, is described in detail in Bulletin 618-54 available from Reid Bros. Co., Inc., Dept. G, Beverly, Mass. Designed with the operator in mind, the grinder has finger-tip level controls, one-piece column casting mounted on the base for maximum rigidity, hand scraped ways for accuracy, etc.

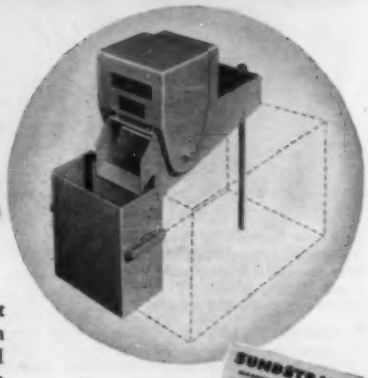
32. Mounted Wheels. Chicago resinoid bond mounted wheels are regularly being used at speeds up to 100,000 rpm. Wheels are particularly suited for snagging and other heavy-duty operations and for cutting metals that are relatively soft and ductile, such as brass, aluminum and magnesium. A catalog sheet, giving this and information on other bonds and showing many of the styles and shapes of wheels and their prices, is available from the Chicago Wheel & Mfg. Co., Dept. GW, 1101 W. Monroe St., Chicago 7, Ill.

33. Wheels for Carbide Tools. Literature on the new aluminum oxide M.M. process wheel for grinding all types of sintered carbide tools is available from Macklin Co., Dept. 65, Jackson, Mich. A fine, loose abrasive is embedded, in pellet form, throughout the wheel and the fine grain is constantly between the metal and the wheel as the tool is applied, permitting the wheel matrix to be made harder.

34. Internal Grinding. A colorful booklet on alignment for better internal grinding has been issued by Bryant Chucking Grinder Co., Dept. GF, Springfield, Vt. The booklet explains why truing the wheel does not always eliminate errors in the wheel form,

$1927.12
SAVED PER YEAR
...with Sundstrand Magnetic Coolant Separator

Installation of a Sundstrand Magnetic Coolant Separator on a grinder, as shown above, resulted in a yearly saving of $1927.12. Further, instead of cleaning the coolant tank twice daily, it now requires cleaning only *twice weekly*. Cost of the installation is approximately $495.00. The unit requires no attention and little or no maintenance.



Easily Installed Without Additional Piping

An important feature of this magnetic coolant separator is that it can be dropped into position on most open type coolant tanks. No additional piping is required. Install one on your present equipment and compare its efficient operation with other units.

Free Additional Data

This folder will give you the complete facts on the Sundstrand Magnetic Coolant Separator. Write for your copy today. Ask for bulletin 455M.

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SUNDSTRAND
Magnetic Products Co.
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why grinding the chuck does not overcome all workhead errors, and why lengthening the traverse stroke or swiveling the workhead does not always correct the geometry of the hole. Understanding the proper alignment of an internal grinder will assist the user to produce more accurate holes on a production basis.

35. Band Grinder. The Simplex-M abrasive band grinder, complete with ½ hp heavy duty motor and automatic band tension control, for finishing metals, plastics, wood, fiber, etc., is described in a new manual on finishing issued by Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y. Other styles and sizes are also included in the manual.

36. Spindles. Literature on the complete line of dynamically balanced, extra heavy duty, precision motor-driven spindles or workheads and precision belt-driven spindles or workheads is available from the Standard Electrical Tool Co., 2478 River Rd., Cincinnati 4, Ohio.

37. Cutter Grinding Fixture. Catalog 602, available from Rocheleau Tool & Die Co., 650 N. Main St., Leominster 1, Mass., covers their line of universal radial cutter grinding fixtures. Included is the No. 6 fixture which, when used with the No. 6A heavy-duty, right-angle, ballbearing spindle workhead, will do 5 operations without removing cutter from its arbor, it is claimed.

38. Drum Sanders. Information on Cone-Loc drum sanders, which can be used on either flexible shaft or stationary arbor, can be obtained from American Diamond Saw Sales, Dept. GF, 120 N. W. Ninth Ave., Portland 9, Oregon. Made of "high tensile" aluminum alloy, the sanders are precision balanced and safe at speeds up to 4000 rpm (6¼" diameter), and can be re-headed with new abrasive strip in seconds.

39. Surface Grinders. Information on the Hill vertical spindle grinder and the horizontal spindle grinder which feature: open side accessibility; 100% hydraulic table drive; built-in spindle motor; centralized assembly controls; low pressure hydraulic system; one shot lubrication, is available from The Hill Acme Co., 1209 W. 65th St., Cleveland 2, Ohio.

40. Cutting, Grinding, Soluble Oils. The Texas Co., 135 E. 42nd St., New York 17, N. Y. carries a complete line of cutting, grinding and soluble oils. Information on these oils and on the selection of the right oil for a particular job is available from the company.

41. Centers. Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn., has issued a new edition of their booklet illustrating the line of Red-E antifriction high speed and carbide tipped centers. New data relating to grinder and milling machine dogs, basic bearing designs, interchangeable points for shank centers, extra heavy duty bull nose and air foil centers is also included.

42. Microhoning and Microflat Equipment. Microhoning formula, all types of cylindrical Microhoning equipment, information on Microsize and finishing flat surfaces, Microflat equipment, Microhoning tools, fixtures, abrasives, and services of the company, are all covered in a catalog issued by the Micromatic Hone Corp., Dept. GF, 8100 Schoolcraft Ave., Detroit 38, Mich.

43. Roll Grinding Wheels. Simonds Abrasive Co., Dept. G, Tacony & Fraley Sts., Philadelphia 37, Pa., has issued Form ESA-237 on roll grinding wheels as used for regrinding operations for steel mill rolls, paper mill rolls and miscellaneous rolls. Included is a grain and grade recommendation table with special reference to alloy chilled iron work rolls and steel back-up rolls for steel mill applications.

44. Safety Guide. The Grinding Wheel Institute, Dept. GAF, 2130 Keith Bldg., Cleveland 15, Ohio, has issued a simple and concise pamphlet entitled "Safety Guide for Grinding Wheel Users." It lists 20 safety precautions, broken down in the form of "Do's and Don't's," which each grinding wheel user should check when operating a grinding machine. 12 other publications devoted to

Consistent accuracy to the highest degree ... at a Remarkably Low Price!

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HYDRAULIC

Universal (Internal & External) Cylindrical Grinders

10" x 15"

also 10" x 20"

For Tool Room and Production Use

- Rigid construction.
- Easy to operate.
- Service and parts available.
- Reference installations at many leading plants.
- Minimum infeed .00005" per reversal.
- Two week delivery.
- Ultra accurate on roundness and surface finish.

Max. wheel size .....14" x 2½" x 5" hole
Hydraulic table speed ....Infinitely variable
Headstock spindle .....Variable
Collet capacity .....¾"
Internal grinding spindles .....16,000 to 200,000 RPM

Dealerships are available in certain localities. Write for proposal now!

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BY "American"

OUTLASTS— OUTPERFORMS OTHER TOOLROOM WHEELS

Combines the cool cutting of open structure wheels with ability to hold size, even with deep, heavy cuts. Particularly adapted for toolroom operations using straight, dish, cup, or cylinder type wheels or segments. Also ideally suited for cylindrical or centerless grinding jobs.

BETTER BY TEST

Report from toolroom tests by a leading bearing manufacturer: An "AMERICAN" wheel (7 x ½ x 1¼) 77A60 HV-22 Aluminox took from .001 to .003 more down feed than the wheel regularly used on surfacing high speed as well as high carbon high chrome steel.

For a destruction test this wheel took a .050 cut on a piece of high speed steel 4 x 3 x 1½ with .010 to .015 hand cross feed and ground across the piece without burning.

Try this surprising new 22 Bond Wheel in your shop. Seeing is believing. Ask for descriptive folder . . . just mail the coupon today!

American Emery Wheel Works
Red Bridge, Providence 1, R. I.

Send folder describing your new 22 Bond Vitrified Wheel.

Your Name.....

Title.....

Company.....

Address.....

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safety are also listed in the pamphlet.

45. Honing Machines. Plugmatic sizing which works automatically to give bore-to-bore size control over every piece honed, electronic control of hone expansion, and extra-deep honing stones, are features of the vertical and horizontal honing machines described in Catalog Bulletin 5001 available from Barnes Drill Co., 878 Chestnut St., Rockford, Ill.

46. Surface Grinders. Copies of two booklets, one entitled "Work Done on the Blanchard" (4th edition), and the other entitled "The Art of Blanchard Surface Grinding," may be obtained from the Blanchard Machine Co., 64 State St., Cambridge 39, Mass. Many interesting case histories, installations and applications are included.

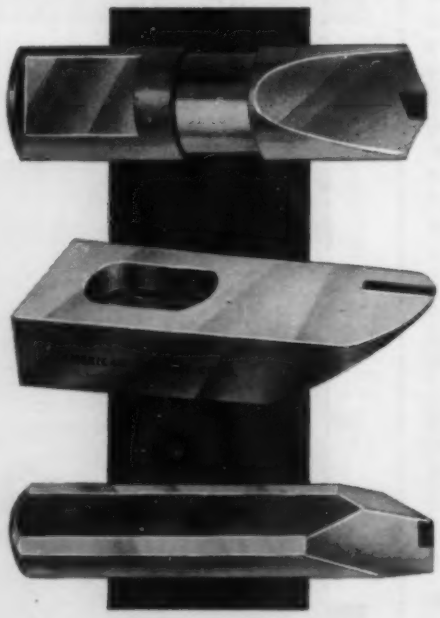
47. Spindles. Literature on all types of precision spindles may be obtained from Pope Machinery Corp., 261 River St., Haverhill, Mass. All spindles have radial and axial rigidity capable of properly supporting modern cutting tools on high production work and large shafts for extra rigidity.

48. Magne-Blox & Radius Dresser. A folder on Magne-Blox, which are claimed to grind work square or parallel, hold round pieces, save magnetic chucks, etc., and a folder on the "Little Wonder" radius dresser for dressing and shaping grinding wheels up to 1" convex or concave without diamond, are available from George Scherr Co., Inc., 200-GF Lafayette St., New York 12, N.Y.

49. Grinding Oils. To help select the proper grinding oil for a particular job, the D. A. Stuart Oil Co., 2729-33 S. Troy St., Chicago 23, Ill., has issued a bulletin on precision grinding oils: hard acting grinding oils for grinding soft, tough, stringy material such as stainless steels, monel metal and high temperature alloys; medium acting grinding oils for use on average work; soft acting grinding oils recommended when the work material is of high hardness.

50. Magnetic Chucks. The complete line of T-P superpower magnetic chucks, both electromagnetic and permanent magnet, are described in a Handbook issued by the Taft-Peirce Mfg. Co., Dept. GF, Woonsocket, R.I. Superpower magnetic chucks combine maximum holding power with maximum working surface. Magnetic losses are low, and rigid one-piece all-steel body is waterproof and shockproof, it is claimed. Available in practically all

SHAPED DIAMOND TOOLS



25 years ago accuracies of more than .002 inch were exceptional. Today, every diamond tipped shaped tool manufactured by the American Coldset Corporation is guaranteed to have—

- **Diamond radius as specified and concentric within .0001 inch.**
- **Centerline of radius and locating flats co-linear within .0005 inch.**
- **Matched tools with corresponding dimensions similar within ± .0002 inch.**

COLDSET

American Coldset Corp. 87-89 Court Street Paterson 3, New Jersey

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TO OBTAIN LATEST DATA ON GRINDING AND FINISHING EQUIPMENT, PRODUCTS, TOOLS AND METHODS MENTIONED IN THIS ISSUE OF GRINDING and FINISHING

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THESE BUSINESS REPLY CARDS ARE FOR YOUR CONVENIENCE AND TO SAVE YOUR TIME

standard sizes and shapes, including one that tilts or swivels to save setup time and a fine mesh chuck to hold small or thin sections.

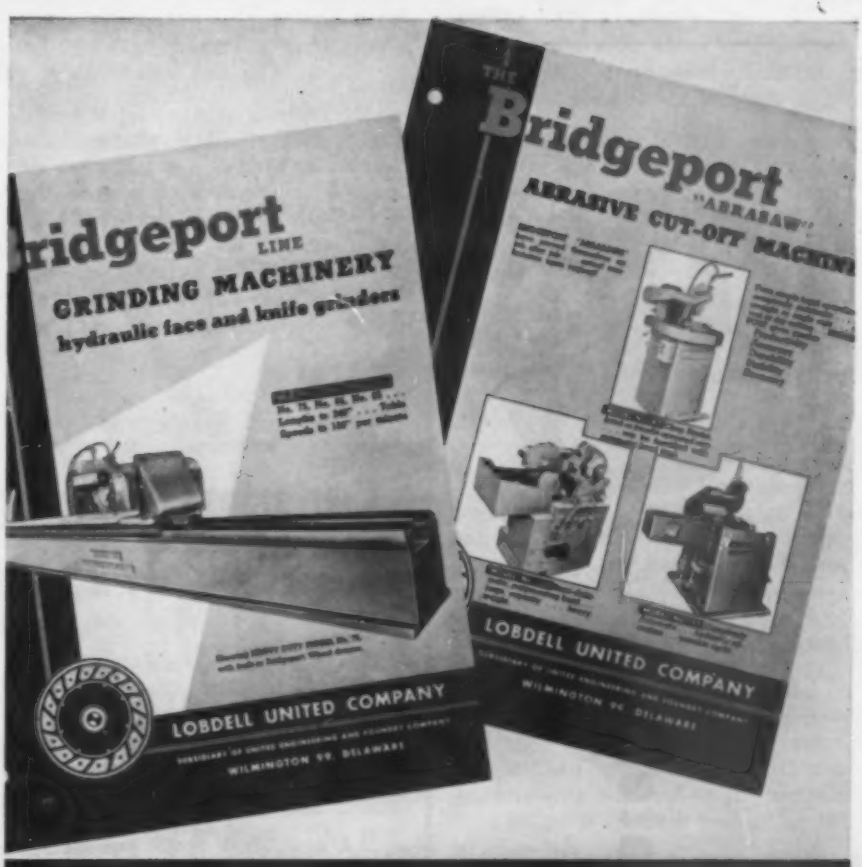
51. Diamond Dressers. Diamond Products, Inc., 333-GF Prospect St., Elyria, Ohio, has available Catalog No. 2 on their line of diamond dressers. Information is given on single stone diamond dressers, their use and abuse; shaped diamond tools; phonopoints; cone point, chisel edge and thread grinder dressers; tandem type, tri-set, unispace set and multilayer set diamond dressers; Prestalloy profile dressers and diamond impregnated dressers. Correct application and operating instructions for diamond dressers is also included.

52. Rotary Table. A folder, issued by Vulcan Tool Co., 730-G Lorain Ave., Dayton 10, Ohio, gives complete information on their motorized rotary table for lapping and grinding. Rotary table is air operated in two sizes, 6" and 10" diameter, and has variable speeds 40-100 rpm. Flanged studs or bushings, bearing spacers, forming rolls, etc. can be ground. Valve plates, gages, bearing spacers, and parts requiring extreme flatness or fine microfinish, etc. can be lapped.

53. Wheel Dressers & Cutters. Catalog 75, The Desmond-Stephan Mfg. Co., Dept. GF, Urbana, Ohio, covers their complete line of grinding wheel dressers and cutters. Included are: Huntington dressers in five sizes; ball bearing equipped heavy duty dressers for use on large high speed wheels; Beltbrasive dressers claimed to lengthen life of abrasive belts, discs, drums; Diamo-Carbo dressers for tool room wheels, etc.

54. Reciprocating Hand Machine. Weighing less than one pound, the Di-Profiler reciprocating hand machine, for cutting, roughing, finishing, has a speed of reciprocation adjustable from 0 to 100 strokes per second and a controlled stroke variable from 0 to ¼". Di-Profiler is used on jobs like internal holes and irregular dies, tool edges, corners, small areas, grooves, etc. Complete information in illustrated price list DG-555 available from Engis Equipment Co., Dept. G, 431 S. Dearborn St., Chicago 5, Ill.

55. Grinding Wheels. Bulletin No. 14, available from Waltham Grinding Wheel Co., Dept. GW, Waltham, Mass., contains brief summaries of all the various types of grinding wheels and abrasive products in vitrified, resinoid, and shellac bonds which the company manufactures. Charts of marking symbols and typical uses of the wheels are also included in the bulletin.



NOW! THESE NEW BULLETINS TELL ALL ABOUT

BRIDGEPORT GRINDING AND ABRASIVE CUT-OFF MACHINES

With their recent acquisition of the Bridgeport Line, LOBDELL UNITED DIVISION, United Engineering and Foundry Company, announces the publication of these two new bulletins. One covers the Bridgeport Line of Grinding Machinery and the other explains the Bridgeport Line of "ABRASAW" Abrasive Cut-Off Machines.

In the Grinding Machinery bulletin, illustrations, specifications and features are well brought out on the complete range of sizes of Face and Knife Grinders, Vertical Spindle Surface Grinders, Traveling Head Knife Grinders and Floor Grinders.

Similar information is equally as well illuminated in the "ABRASAW" Cut-Off Machine Bulletin—also, some interesting performance data and photographic examples.

Write for copies of these bulletins to:

LOBDELL UNITED DIVISION

1836 WILMINGTON 99, DELAWARE 1955

UNITED ENGINEERING AND FOUNDRY COMPANY

Encircle No. 276 on card opposite Page 86

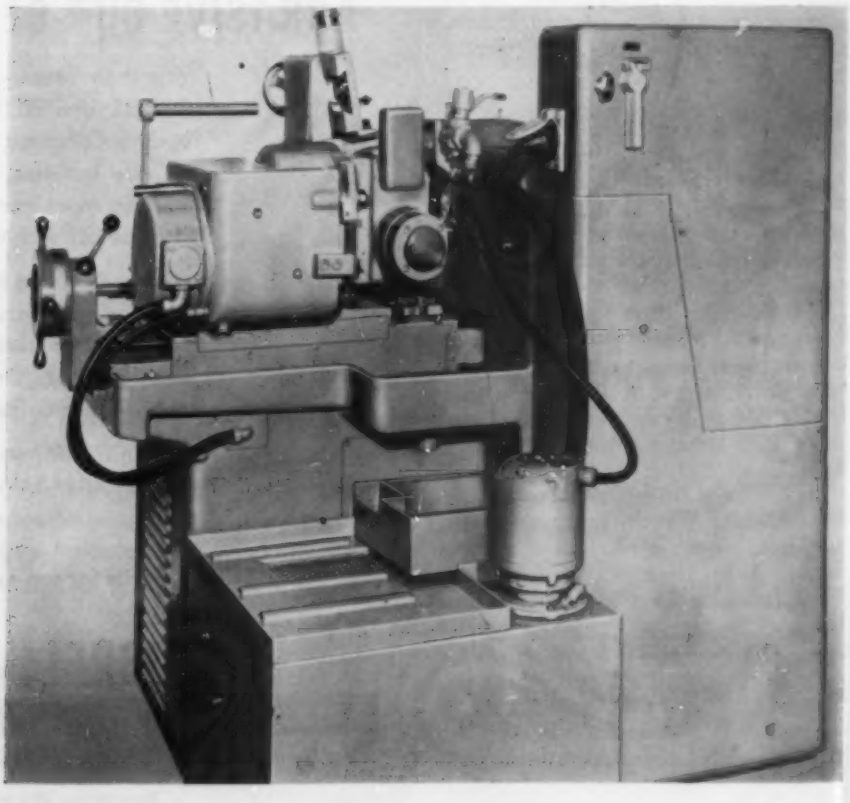
Whats's New in Equipment and Materials

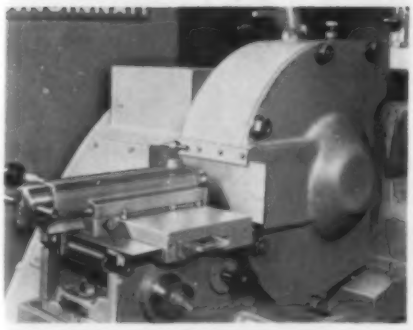
Centerless Grinding Machine For Parts 1/2" Diameter

A new, small sized, general purpose centerless grinding machine, designated the No. 0, is announced by Cincinnati Grinders Inc., Dept. GF, Cincinnati 9, Ohio.

Designed for the wide range of metallic and non-mentallic parts ranging up to ½" in diameter, the lower power consumption, reduced floor space, and lower capital investment required by this machine make it an efficient, low-cost producer of small shafts, drills, pins, clock parts, instrument parts, etc.

The grinding wheel spindle is mounted in Cincinnati's exclusive Filmatic spindle bearing. The bearings are self adjusting for heavy roughing cuts or light finishing cuts and require no maintenance. Spindle lubrication is





automatic and positive, and an automatic cut-out is provided to stop the spindle driving motor if lubricant pressure should fail.

The spindle bearings are mounted in the bed casting, without joints or sliding elements.

The regulating wheel unit is carried on the base in two wide dovetail slides to permit adjustment of the workrest in relation to the regulating wheel, and adjustment of both workrest and regulating wheel in relation to the grinding wheel.

A swivel plate is located between the lower slide and the base to permit correction of slight errors in straightness without having to retrue the wheels.

An oil-shot lubricating system assures adequate lubrication of the regulating wheel slide for normal hand operation.

The regulating wheel speeds are infinitely variable, under the control of a single handwheel, from 22 to 300 rpm to permit selection of the speed required.

Adjustments of the regulating wheel unit are accomplished by means of a pilot-type handwheel equipped with large diameter micrometer dial, and a hand infeed lever permits rapid grinding by the infeed method.

The standard grinding wheel truing attachment is hydraulically actuated and trues the wheel to a straight cylindrical shape and to slight tapers if desired. A profile hydraulic truing attachment is available at extra cost if it is desired to true the wheel to formed profiles or multiple diameters. The standard regulating wheel truing attachment is of the straight screw-type.

All truing attachments are of the diamond type. Profile type truing attachments are equipped to take either round or flat profile cams.

Workrests are available for infeed or thrufeed methods of grinding. A Roto-Feed automatic infeed attachment is available at extra cost for the automatic grinding of parts by the infeed method.

Grinding wheels are 16″ maximum diameter with 10″ diameter hole and maximum width of 4″. They are mounted in separate wheel mounts with four adjustable balance weights.

Regulating wheels are 9″ maximum diameter with 4″ diameter hole and maximum width of 4″. They mount directly on the end of the regulating wheel spindle; no wheel mount is required.

A separate cutting fluid tank of 40 gallon capacity and an individually motor driven cutting fluid pump of 21 gallons per minute capacity, are located at the rear of the machine and are standard equipment.

All electrical motors are enclosed to protect them from dust, grit and cutting fluid. Grinding wheel driving motor is 5 hp, regulating wheel driving motor ½ hp, hydraulic pump motor ½ hp, and coolant pump motor 1/10 hp. Electrical controls are all located in a dust-tight control panel.

Use HANDY Card, opposite page 88. Encircle No. 101

Special Gear Grinder Grinds Helical Gear Teeth

A special gear grinder that grinds the internal helical teeth on a ring gear about 18in. in diameter and only ½-in. thick has been developed by National Broach & Machine Co., 5600 St. Jean Ave., Dept. F, Detroit 13, Mich.

The machine is basically a Red Ring Model SGF-18-in. external helical gear tooth grinder modified to meet the requirements of the internal helical gear. To grind the internal gear teeth with a grinding wheel spindle designed for external helical gears, the wheel spindle is swung to an angular setting corresponding to the helix angle of the internal helical gear.

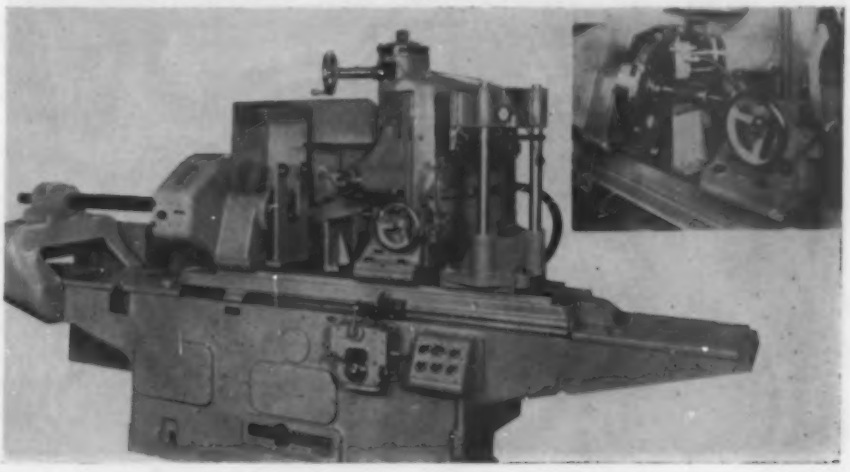
The top surface of the wheel rather than the bottom contacts the work. The table travel is limited so that the gear does not contact the motorized grinding wheel spindle. A special 'upside-down' grinding wheel dresser attachment is mounted on the machine table to dress the top surface of the grinding wheel.

This wheel dresser unit has templates for dressing each side of the wheel individually. It has two vertical columns upon which the dresser base can slide to proper location to engage the wheel for dressing. This arbor includes the arbor gear and gear assembly is mounted on the machine centers.

When the gear is positioned for grinding, the wheel is dressed and the internal gear teeth are ground one space at a time and indexed to the next tooth space. A helical guide bar rotates the gear in correct relation to the table reciprocation movement during the grinding of each tooth space.

Use HANDY Card, opposite page 88. Encircle No. 102

The special Red Ring gear grinder that grinds the teeth on an internal helical gear about 18-in. in dia. and ½-in. thick. The inset view shows a closeup of the gear mounted in its arbor assembly in grinding position.



Precision Gear Grinder

The Belock Instrument Corporation has completed development of its new fully automatic precision gear grinder for spur and helical gears and is now introducing it to the machine tool market.

This machine represents a new approach to precision gear grinding.

Although a high production machine, it was so designed as to make short run jobs economically feasible.

A number of design goals have been achieved in its development:

Expensive tooling has been eliminated. A special involute dial is set to the proper index number to produce the proper involute shape for the particular size gear to be ground. Three change gears are selected for the number of teeth on the gear and the proper dressing cam is inserted in the diamond dresser.

Expensive inventories of special tools that may never be used again are eliminated.

Cumbersome construction was overcome by incorporating the latest in design techniques and by packaging the electrical system and its automatic controls in a separate cabinet.

The latest engineering techiques were used to provide fully automatic operation. The operating cycles are programmed on the control console. One operator can tend several machines.

The simplicity of design eliminates the necessity of specially trained personnel.

All of the hydraulic, electrical and mechanical components are so placed to make servicing fast and simple.

Automatic dress interval is set on the control console to eliminate judgment error on the part of the operator. At the end of the preset interval, the grinding wheel automatically positions itself for dressing and a light goes on to signal the operator. He then merely sets the amount to be dressed on a dial and turns a lever to start the dressing operation.

Approximately 30 seconds are all that is required to complete the dress operation.

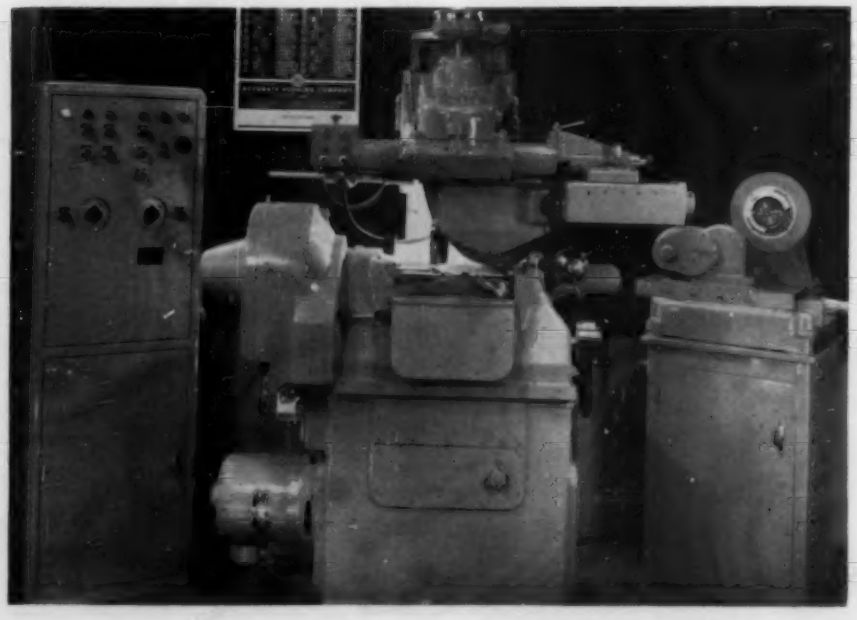
In view of the high speeds and increased loads encountered in jet engines, gas turbines and aircraft accessory drives, it is necessary to grind the root filet to eliminate stress concentration failures in this area.

Capacity of the machine is ¾″ to 7½″ pitch diameter and will handle 4 to 32 pitch. The grinder is only 48″ x 36″ x 70″ high and weighs 2700 lbs. Total power consumption is less than 1.7 H.P.

Use HANDY Card, opposite page 86. Encircle No. 103

Close-up view showing mounted work piece. Grinding wheel is shown above and to the right. Large dial at right is for setting the proper involute for the gear being ground.

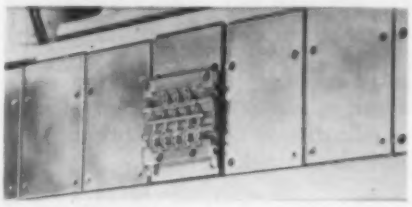
The new Belock fully automatic precision gear grinder (center in photograph). On the left is the console which contains all of the electrical safety controls and set up dials. On the right is the wheel crusher for pre-forming the grinding wheels, prior to the finish diamond dress on the machine.



New Belt Grinder

The BG-8 Automat, manufactured by the Engelberg Huller Company, Dept. GF, Syracuse, N.Y., is a new belt grinder equipped with a self-powered, continuous work feed and an 8 x 107″ abrasive belt.

Two typical applications of the new machine are (1) grinding 2100 knife handles an hour; (2) finishing the sides

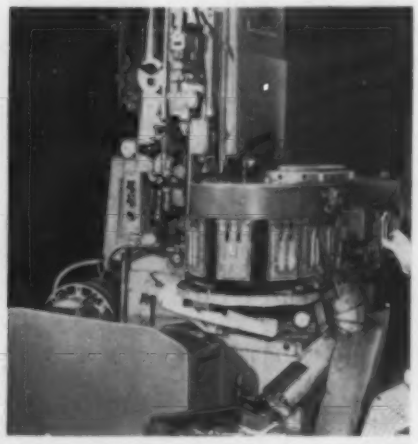


of plier handles at the rate of 1440 parts per hour. Tolerances of plus or minus .0005″ to plus or minus .001″ were maintained for both jobs.

Work pieces for the new unit are manually loaded but automatically ejected. Ejectors consist of either a positive stop to slide a part off its supporting ledge or a spring claw entering a groove in a pad behind the work. For normal parts, the supporting ledge is shaped as a shallow V-block, with work supported close to the belt.

The feed unit has 21 fixture plates, each 3¾″ x 6¼″. The number of parts that can be loaded on each fixture plate is limited only by their size. Moved by parallel roller chains, each fixture plate is tracked to the leading edge of the abrasive belt, riding on hardened and ground shoes over hardened and ground steel rails. As feed speeds are variable; fixture plate rates of travel can be set at 1090, 1350, or 1750 per hour.

Production rates up to 14,000 or more pieces per hour are possible.

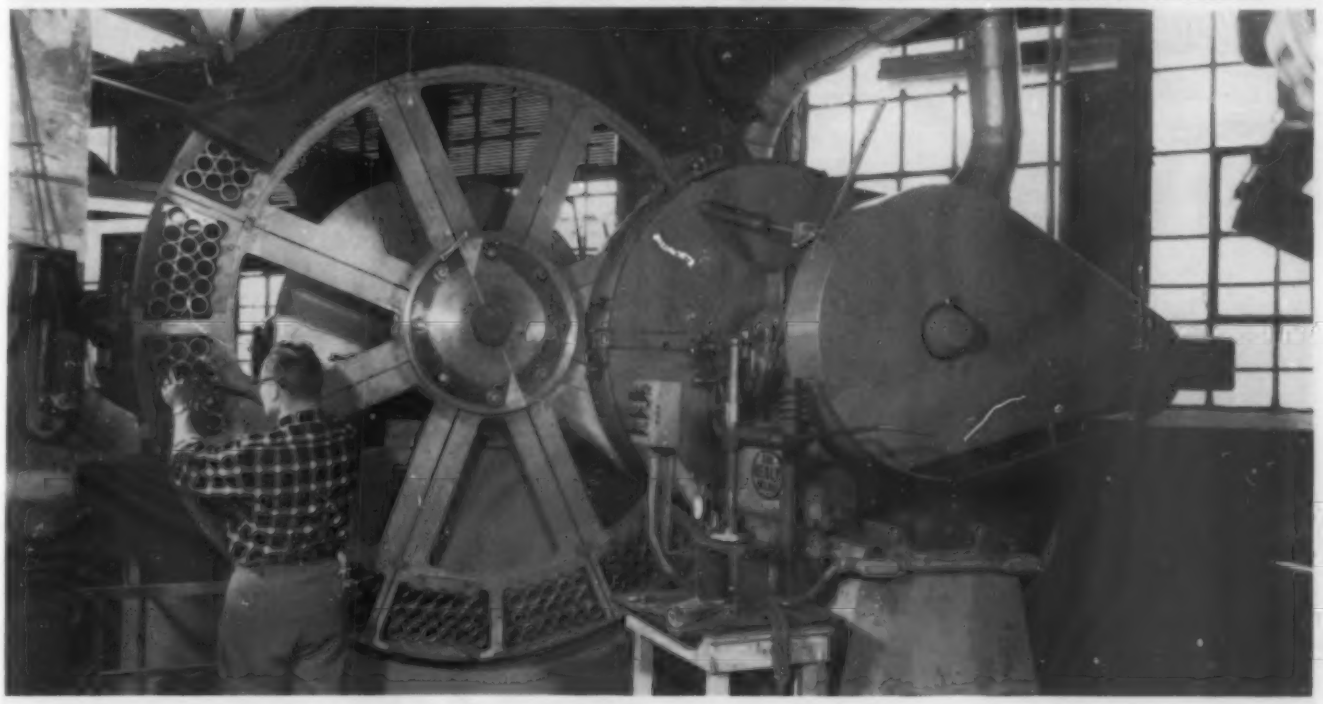


The BG-8 Automat is 72 inches high, 48 inches wide and 48 inches deep. Its coolant system consists of a 40-gallon tank in the base of the unit, divided into two sediment zones, with a cleanout at one side. Inside the belt housing, a fan-shaped jet sprays the belt.

Use HANDY Card, opposite page 86. Encircle No. 104

BESLY Grinderscope

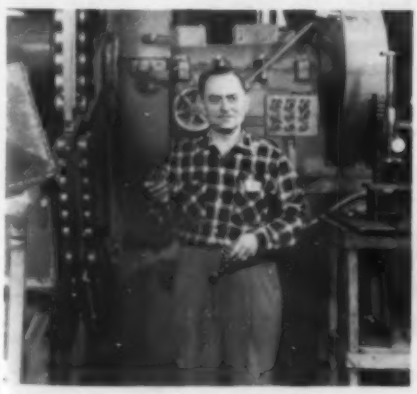
NEWS AND VIEWS ABOUT WAYS TO CUT COSTS WITH MACHINES AND METHODS
FROM BESLY-WELLES CORPORATION, BELOIT, WISCONSIN



"Ferris Wheel" Spring Grinder Boosts Production 2½ Times

When the Illinois Coil Spring Co., Chicago, recently installed a Besly #226 Double Horizontal Spindle Grinder with a specially designed feed wheel, the boys in the grinding shop promptly dubbed it the "ferris wheel". And well named it is. The spoked feed wheel that carries springs between two abrasive discs is almost seven feet in diameter.

This new grinder is a big machine production-wise, too. Equipped with 53-in. discs, it grinds both ends of heavy springs at a rate of 1000 per hour. A 30-in. machine, previously used, required two and one-half hours to grind the same number.



"It's a money-saver for my boss", says Ernest Thomas, grinding superintendent, in describing the new Besly Spring Grinder.

Springs Used in Automatic Transmissions

The springs are made from 5/32-in. dia. oil tempered wire. They are 2½-in. O.D. and are six inches long. The grinder removes approximately 20% of the metal in each end coil, producing a 270° ground surface. Squareness of each end is maintained within close limits. These springs are used by one of the major automotive manufacturers in automatic transmission units for several popular makes of cars. Because of its higher production and labor savings, the grinder has been an important factor in securing jobs such as this in the highly competitive automotive industry.

Abrasive Costs Reduced 40%

"Compared to the 30-in. grinders we formerly used to grind transmission springs, this larger grinder has reduced abrasive costs by approximately 40%", states Mr. G. P. DeChambre, Chief Engineer at Illinois Coil Spring Company. He attributes the savings in abrasives to the use of larger discs without center-holes, and to a unique feed wheel arrangement. The discs are furnished by Besly-Titan.

Eccentric Action "Scrubs" Discs, Cuts Dressing

The feed wheel revolves with an eccentric motion which moves the springs back and forth as they are carried between the two discs. This motion produces a "scrubbing" action which keeps the discs sharp longer and reduces dressing by about 50%. A greater area of the disc is also used because of this eccentric action, explains Mr. DeChambre.

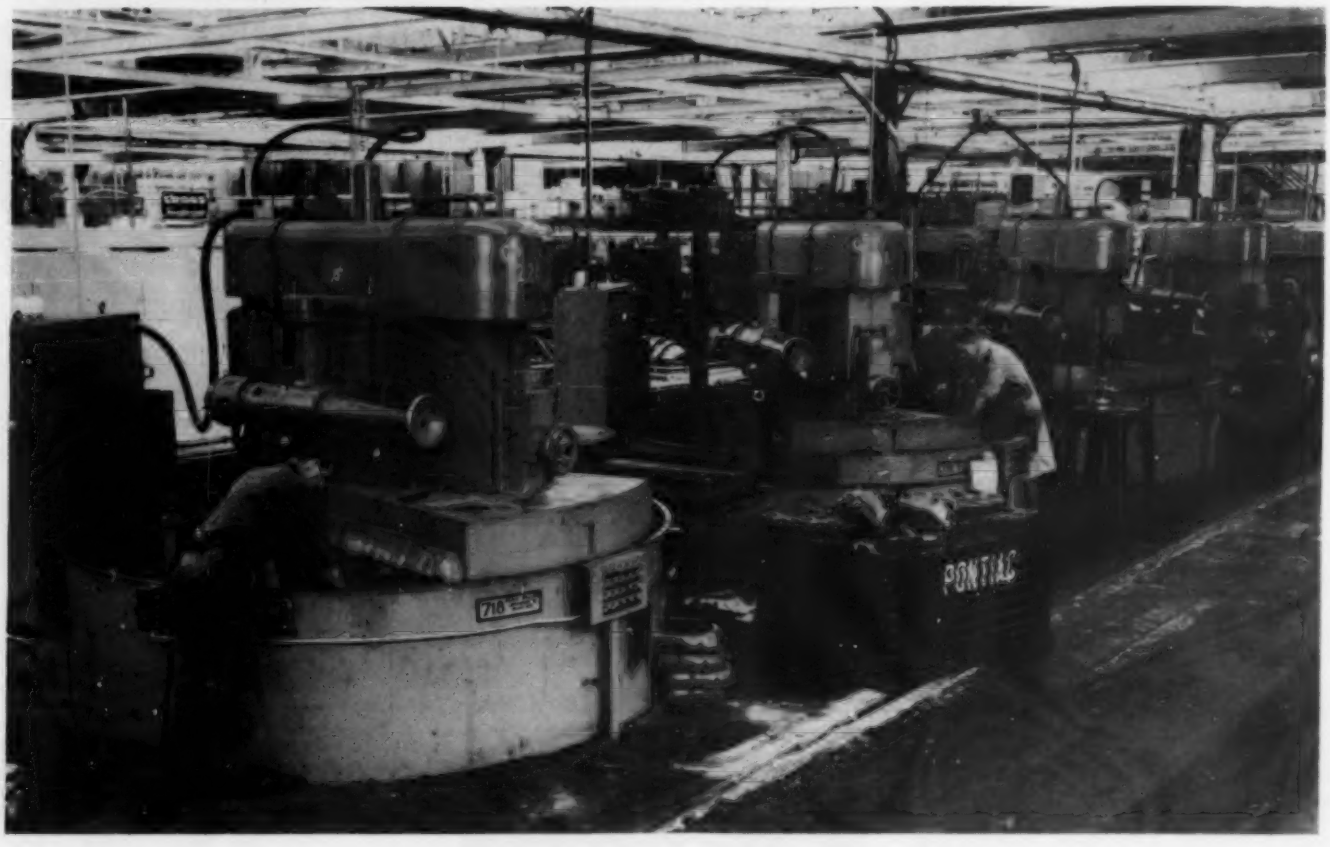
Besly Grinders have been used exclusively by Illinois Coil Spring Co. since it was founded 27 years ago and Besly-Titan Abrasives are widely used in the shop.

See More Besly Case Studies—Next Three Pages

Encircle No. 277 on card opposite Page 86

Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.



At Pontiac Motor Div. of G.M.C., Besly-Bowen Grinders Speed Production of Automotive Flywheel Housings

"Remove approximately 3/32-in. of stock from *three* faces of a thin wall, easily distorted cast iron flywheel housing, hold flatness within .005-in., parallelism within .003-in.—and do it at the rate of one completed housing every 72 seconds or 150 finished surfaces per hour."

This was the assignment for seven Model 718 Besly-Bowen grinders recently installed at Pontiac's Motor Machining Plant #9. The grinders have proved so successful at this high precision, high production job that both flatness and parallelism are being held to .002-in. and a completed housing is now being finished every 65 seconds!

HOW IT'S DONE

The Model 718 Besly-Bowen Grinder is a radial head type which grinds first at one station, then automatically raises the abrasive disc and swings over another station where the disc is automatically lowered into contact with the work. This permits work to be loaded and unloaded at one station while grinding progresses at the other.

The grinder is equipped with two 40-in. diameter rotary work tables. At Pontiac, these are fixtured so that three housings are held with each housing presenting a different face to the abrasive. To grind all three surfaces, the operator simply moves a housing from one work station to the next until all three sides have been finished. One completed housing is removed after every grinding cycle and a new housing placed in the remaining empty fixture.

According to Pontiac production men, this unique system of multi-station grinding has simplified a difficult machining problem that would have required three separate operations with other types of equipment or methods. They also point out that production is continuous with neither the machine nor the operator waiting on the other. Automatic sizing, automatic cycle control, and air-operated clamping fix-

Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.

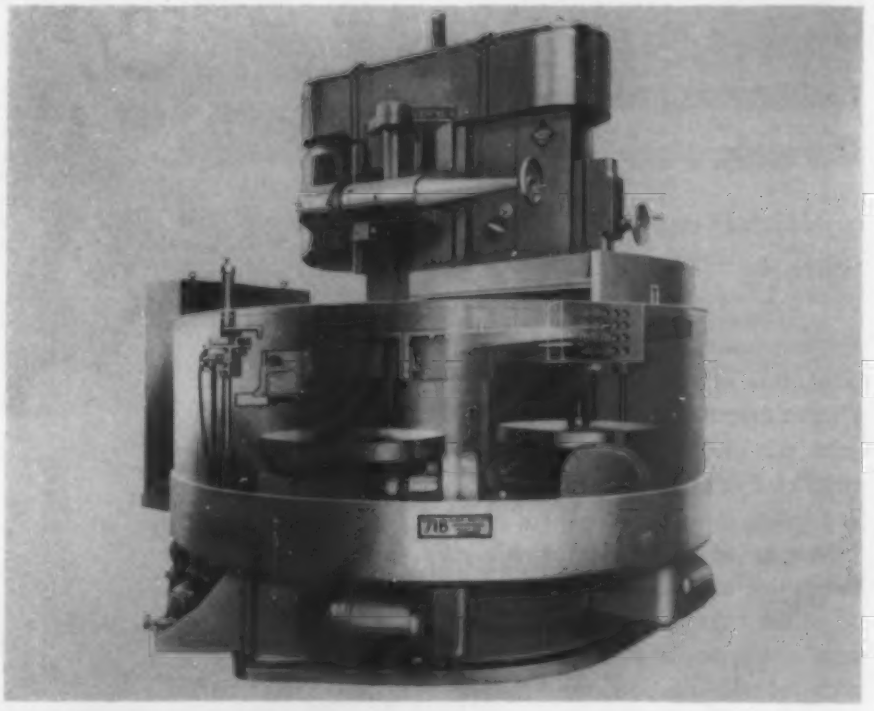
Besly-Bowen Grinders at Pontiac . . .

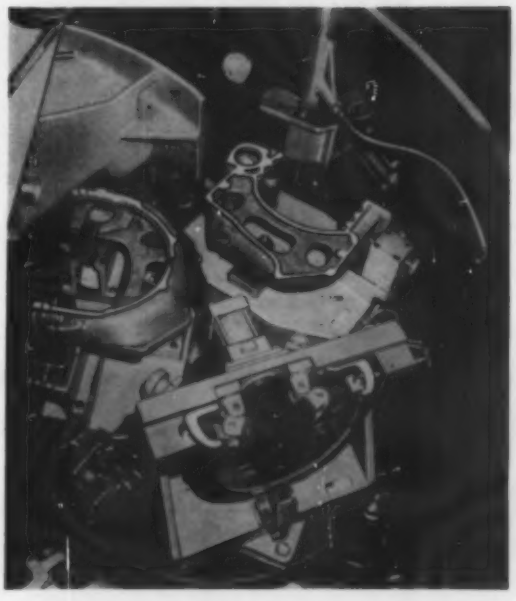
tures free the operator for unloading and loading duties. A convenient push-button station permits manual control of the grinder at any part of its cycle.

Accuracy and lack of heat distortion are also important factors contributing to lower production costs for Pontiac. The multiple number of cuts that the grinder makes over the entire surface of the housings keeps heat at a minimum. Heavy shearing action common to other methods and equipment is completely eliminated. The grinder actually has a "feather-touch" with its controlled down-feed and spark-out that delivers consistently close tolerances.

Abrasive wear of the 26-in. diameter disc is .0005-in. per table load. Grinding is done wet with coolant supplied to the head from a centralized coolant system.

This new Besly-Bowen Model is the latest addition to the Besly line of surface grinders. There are types and sizes for almost every grinding job.





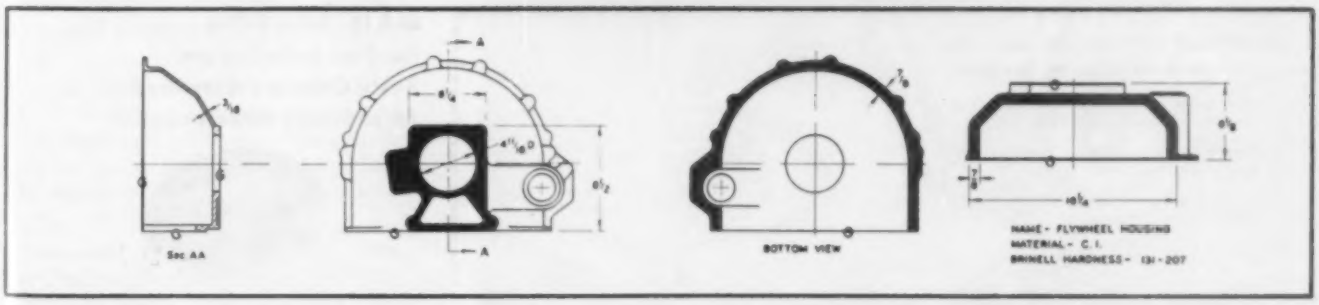
X-ray view of Besly-Bowen Grinder shows the two rotary work tables. Large table area gives wide choice of fixtures and arrangements.

●

A close-up of one of the two rotary work tables. Note how each work station presents a different face of flywheel housing to the abrasive.

●

Drawing below gives dimensions of one of several flywheel housing sizes ground on Besly-Bowen machines. Surfaces indicated by heavy black lines are within .010-in. for size, .002-in. for flatness and parallelism.



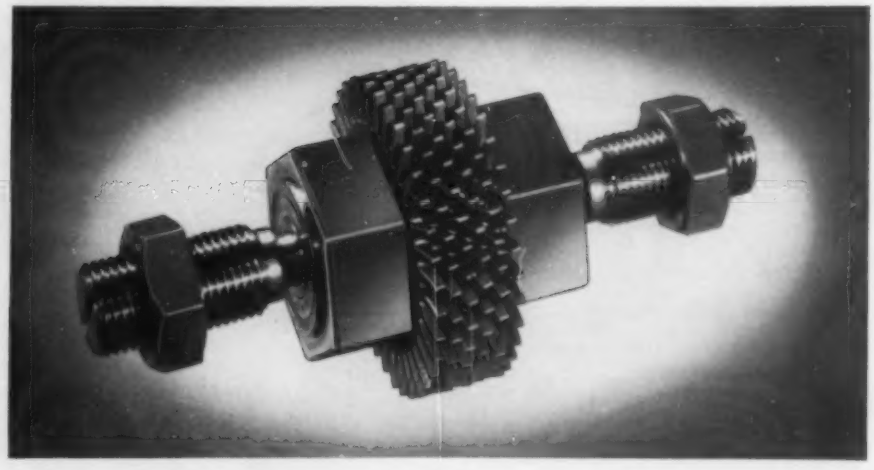
Mail coupon next Page for Bulletin on Besly-Bowen Grinders.

Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.

Unique Dresser Cutter Assembly Developed

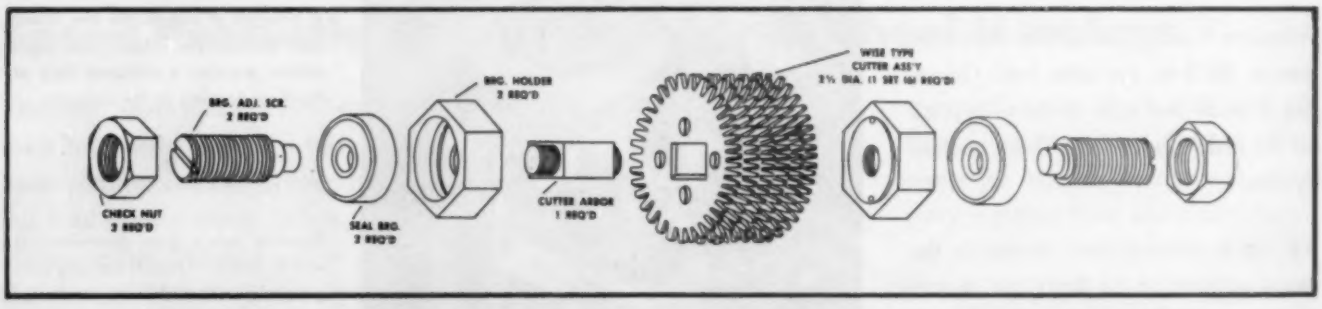
Lasts Longer and Dresses Better, Costs Only $8.25



Unlike broad tooth dressers commonly used, this new Besly "Wise Type" Dresser Cutter Assembly has slim "fingers" that pick off abrasive grains instead of crushing the abrasive surface and rolling the grain off. There is no "softening" of the disc due to dressing; the cutting action and hardness characteristics remain the same. The "fingers" are arranged on a ball bearing mounted spindle in a staggered fashion which permits continuous contact with the disc and reduces pressure required. For this reason, Besly grinding engineers explain, the assembly lasts longer and does not "dig" and bounce as do broad tooth dressers.

Perfect stagger and longer spindle life is provided by a unique "true-square" spindle. This design has eliminated the troublesome keyways which often become chewed up before the cutters themselves are worn out. No spacing washers are needed with this new assembly—buttons on the side of each cutter give the proper spacing and speed replacement. Replacement cutter sets are taped together for quick mounting and proper "stagger". They slip on the spindle as a unit and are correctly spaced when the tape is removed.

This simplified, yet more efficient design has permitted the new assembly to be priced about 15% below other types currently available. The new Dresser Cutter Assembly fits all Besly grinders using 2½-in. cutters and can be easily adapted for other dresser holders. Use coupon to order or send for catalog data.



Exploded view of the new Besly 2½-in. "Wise Type" Dresser Cutter Assembly. Note the sealed roller bearings, the square spindle and the raised buttons on the cutters which eliminate the need for spacing washers.

BESLY-WELLES CORPORATION, Dept. GFM, Beloit, Wisconsin
Please send the following free bulletins:

- ☐ New Bulletin No. 200 on Besly Double Horizontal Spindle Grinders
- ☐ New Bulletin No. 700 on Besly-Bowen Radial Head Grinders
- ☐ Catalog Sheet on new "Wise Type" Dresser Cutter Assembly
- ☐ Please ship F.O.B. Beloit_____ (quantity) 2½-in. "Wise Type" Dresser Cutter Assemblies, at $8.25 each. Purchase order/check enclosed.

Name.....

Street.....

Company.....

City.....Zone..State.....

MAIL COUPON
for free bulletins on Besly Grinders described on previous three pages

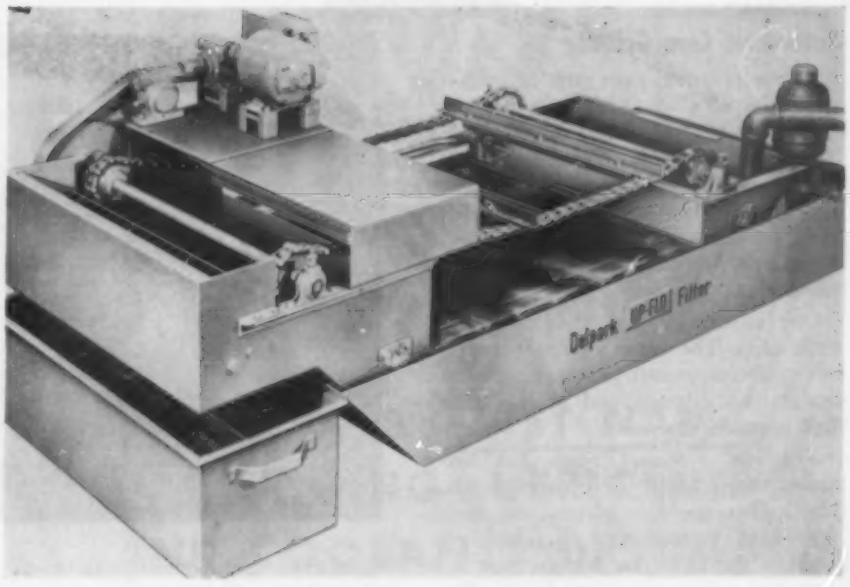
BESLY . . . Makers of GRINDERS AND ACCESSORIES • HIGH SPEED CUTTING TOOLS • BESLY-TITAN ABRASIVES

Up-Flo Filter Uses Permanent Filter Media

The Delpark Up-Flo Filter utilizes gravity to remove the heavier solids before filtration of the liquid through a horizontal bar-type screen. Only the fine particles held in suspension reach the screen. The efficiency of the filtration process is never impaired by deposits.

Chain driven flights operating on a time lapse sequence pass under the filter and remove deposits from the underside of the screen and the area beneath the screen. These flights carry the particles to a device which cleans the flights. Filtered swarf drops into a tote box for disposal. All sizes, flows and capacities are available. Industrial Filtration Co., Dept. U-290, Lebanon, Indiana.

Use HANDY Card, opposite page 86. Encircle No. 105



Flexible Shaft Machine

A new Multi-speed, Suspension-type flexible shaft machine, Model V-40, made by the Stow Manufacturing Co. of 30 Shear St., Binghamton, N.Y., has a hook or trolley mounting.

The Joe Thomas Co. of Lancaster, Pa., is using this machine to grind down the seams on the inside of stainless steel milk tanks. The hook on the V-40 makes it easy to lower this machine through the small hole in the top of the tank. This machine has a ½ H.P. motor and they used an RM40 anglehead running at 4450 R.P.M. and a sanding drum.

This machine can be operated at four different speeds 1725, 2700, 4450 and 6900 R.P.M. and is furnished with a 6 ft. Shaft. Speeds can be changed easily with an eccentric countershaft.

Use HANDY Card, opposite page 86. Encircle No. 106

New Barrel Finishing Machine

An inexpensive standard-model barrel finishing machine with many features of the deluxe models has been added to its line of "Honite" brand barrel finishing equipment, according to Minnesota Mining and Manufacturing Co., Dept. GF, St. Paul, Minn.

Called the VS model, its features include a pivot-mounted gate which closes when the machine is in operation, and a magnetic brake.

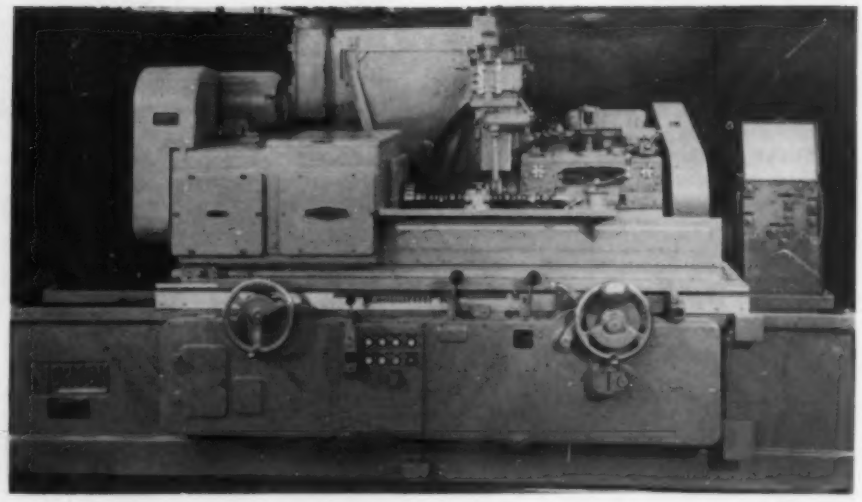
All lubrication points are readily accessible, since the motor, speed reducer, speed changer and brake are mounted in a single unit at the rear. The cylinder can be removed without disassembling the machine.

The VS model is available in three power ranges, with a 1½ h.p. motor for ordinary requirements; a 2 h.p., motor for heavy duty work, or a 3 h.p. motor for extra heavy finishing jobs.

Use HANDY Card, opposite page 86. Encircle No. 107

Automatic Cam Grinder

A new precision cam grinder known as the No. 3 Cam-O-Matic Automatic Cam Grinder has been announced by Norton Company of Worcester, Mass. Faster grinding of automotive type camshafts with better finish and simpler and sturdier construction details are among the improvements over former models.



One of the features is the positive work drive. The use of a Gilmer timing belt produces smooth work rotation by eliminating slippage and at the same time requires less power.

The No. 3 Cam-O-Matic has two automatically controlled workspeeds. The higher speed is adjuted for optimum rate of stock removal. The slow speed is the ideal rate for the best accuracy of contour and fine finish. The change from the fast to the slow speed is automatic and its timing can be easily adjusted by a simple setting of a small lever on the wheel feed mechanism.

The grinding action has been improved through the use of a heavier one-piece rocking bar of substantially increased cross sectional area. A tapered roller bearing supports the center of the rocking bar.

Another feature is automatic wheel guard truing. The truing cycle commences automatically after the last cam or eccentric has been ground, regardless of the angle of the wheel slide. Since the truing mechanism is built into the wheel guard, there is no swiveling of the wheel head prior to truing when grinding tapered cams. Automatic compensation for wheel wear is built into the new camshaft grinder.

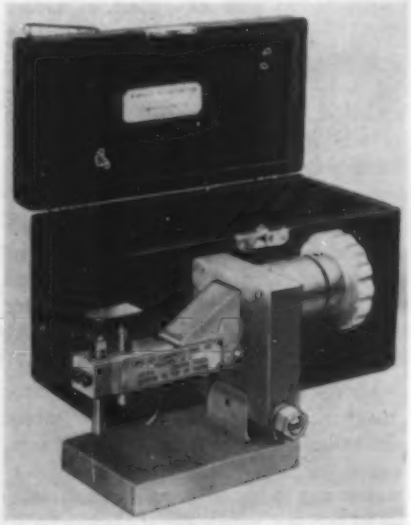
Use HANDY Card, opposite page 86. Encircle No. 108

New Model "SS" Wheel Dresser

This new model wheel dresser, designed and developed for dressing grinding wheels of most diameters, maintains an accuracy of .0002".

Simple to operate and maintain, four stops allow complete control for the dressing of concave or convex radii.

The manufacturer is Somerset Tool Co., Dept. F, Virginia St., Hillside, N.J.



Use HANDY Card, opposite page 86. Encircle No. 109

FULMER HONING MACHINES

FOR PRECISION CONTROL

Swift and Accurate Finishing of Internal Bores

PRECISION IS SURE . . . CLOSE TOLERANCES UP TO .0001 (±)

These are really more than just honing machines . . . for they cut away protuberances from the internal bore (chips are often as long as 6 inches) then finish them to mathematical accuracy. FAST! SURE! ECONOMICAL! You eliminate costly waste of time and material.

This "official U.S. Navy" photo shows one of the largest honing machines ever built finishing to AMAZING SMOOTHNESS a cylinder 30 ft. long and 30 in. dia.

For honing internal bores up to 30-in. diameters and with strokes from 12" to 144" . . . for ferrous and non-ferrous metals, glass, plastic and other materials.

WRITE FOR OUR BULLETIN ON HONING

C. ALLEN FULMER CO.

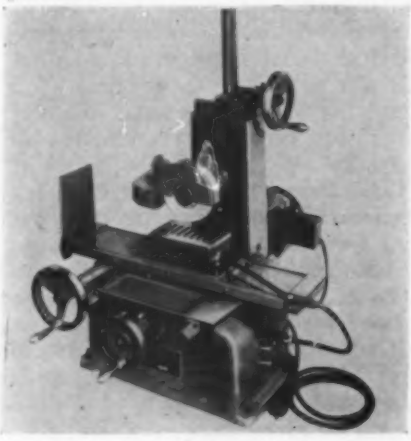
1246 First National Bank Bldg. Cincinnati 2, Ohio

Encircle No. 225 on card opposite Page 86

Bench Surface Grinder For Small Parts

The Sandford Model SG surface grinder is a precision machine of 4″ x 8″ x 6″ capacity suited for dry surface grinding dies, gages, instrument parts and other parts small enough to fit in the hand. The machine may be adapted to wet grinding.

An exclusive method of assembling the grinding spindle, verticle column and bed is said to result in perfectly balanced alignment of these three main parts.



Specifications: magnetic chuck surface, 3″ x 5″, longitudianal travel of table, 8″; transverse travel, 4″; vertical movement of wheel head, 6″; maximum distance between table and 4″ wheel, 6″; spindle speed, approximately 5500 rpm. Sandford Mfg. Corp., Dept. GF, 1026-G Commerce Ave., Union, N.J.

Use HANDY Card, opposite page 86. Encircle No. 110

Feed Polishing & Deburring Machine

The Timesaver is a new automatic feed machine for polishing and deburring metal developed by Timesavers, Inc., Minneapolis 22, Minnesota.

Equipped with an automatic feed, the Timesaver Smooth-O-Matic can handle all types of flat stock and metal sheets, single plane curved metal surfaces and modified shaped and tapered metal pieces.

Use HANDY Card, opposite page 86. Encircle No. 111

W+B INDUSTRIAL LUBRICANTS

WHITE & BAGLEY

AMERICA'S FIRST NAME IN GRINDING LUBRICANTS AND COOLANTS BRINGS YOU THE LAST WORD IN GRINDING AND FINISHING

FIRST to originate and develop water-soluble grinding lubricants, at the beginning of the wet grinding industry . . . FIRST to pioneer and manufacture grinding oils . . . FIRST with a constant and continuing program of research and development, White & Bagley is today famous throughout the world as the maker of a complete line of perfected lubricants and coolants for the metal-working industry. If you want the best solution to any wet grinding problem call on White & Bagley FIRST. Ask us, without obligation, to send a W & B Lubrication Expert into your plant to consult with you.

SOME OF THE BEST-KNOWN GRINDING LUBRICANTS AND COOLANTS ARE:

E-1.
A direct descendant of W & B's first water-soluble, E-1 is the preferred lubricant for the highest reflective mirror finish.

1572.
W & B's Grinding Oil 1572 was specially developed in the 30's for grinding gears, threads, and other forms. Today's 1572 is a leader in the grinding oil field.

1888.
One of the recently developed fluid-type water-solubles, 1888 has proved its effectiveness in both grinding and cutting.

1500.
W & B Grinding Concentrate 1500, designed expressly for grinding ferrous metals, is an extremely popular green transparent coolant.

ORIGINATORS OF GRINDING LUBRICANTS

THE WHITE & BAGLEY CO.

Since 1888

Main Offices & Plant
Worcester, Mass.

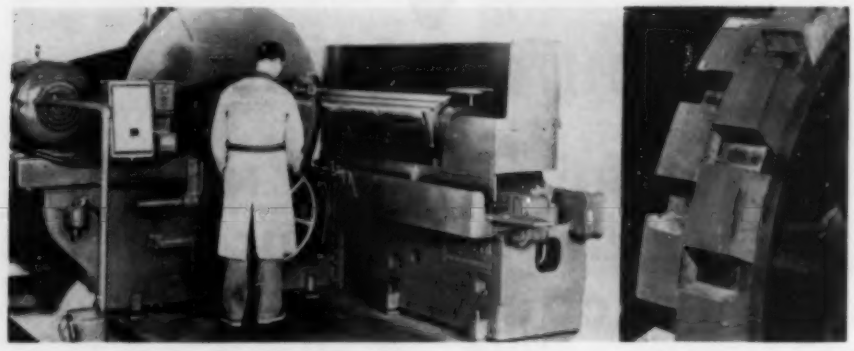
Office and Warehouse Stock
Detroit, Mich.

Encircle No. 226 on card opposite Page 86

Two New Grinders Announced By Hanchett

Two new machines—developed for accurate grinding of shear blades, knives and flat surfaces at a high rate of production—have been added by the Hanchett Manufacturing Co., Big Rapids, Mich., to their line.

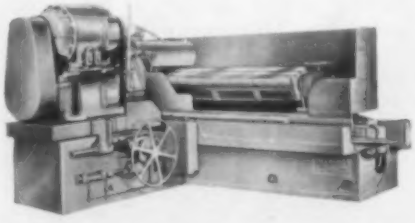
Known as the "Hy-Power" and the "Big 60 Hogger" both machines are recommended for the maximum in heavy duty grinding performance. These machines, according to the manufacturer, will grind shear blades, knives and flat surfaces at a high production rate. Precision accuracies are guaranteed. Features of both machines are as follows:



Capacities of both machines range from 60" up to 296" work piece length. Grinding wheel spindles 5" and 6½" in diameter are mounted with extra heavy duty precision taper roller bearings set in massive cast iron housings. Motors for driving the segmental type grinding wheels range from 30 hp. up to 75 hp., dependent upon work piece capacity and production requirements. Table Drives are hydraulic with dual cylinders and specially designed mounting features to eliminate all piston sag so that guaranteed smoothness of operation of the work table is assured, entirely free from vibration or chatter. Standard table speeds are 10′ to 120′ per minute. Faster table speeds can be furnished when required.

Hy-Power Grinder

The Hy-Power Shear Blade and Face Grinder is equipped with 30" or 36" diameter heavy duty segmental grinding wheel chucks mounted to an extra large diameter heavy duty wheel supporting flange. Machine Ways are extremely wide. The "V" Ways are 5" wide and the flat ways 3" wide. Large Heavy Duty Square (4 sided) revolving knife bars are standard equipment with a choice of 10" or 12" work faces available, and are operated through



worm and worm gear mechanism with full 360 degree adjustment (graduated dial). Large angle plates for holding flat surface work pieces to be ground are also standard. All knife bars are ground and balanced. Clamping arrangements are available in Manual, Magnetic, Hydraulic or Air Operated types.

Big 60 Hogger

The Hanchett Big 60 Hogger (patented) uses a grinding wheel 60" in diameter of periphery segmental type mounting (patented) and is made up of 40 large abrasive segments alternately mounted. Elimination of burn,

PRECISION MOTOR-DRIVEN SPINDLES OR WORKHEADS

RUGGED CONSTRUCTION
Plus
DYNAMIC BALANCE
Plus
PRECISE ENGINEERING
OF STANDARD SPINDLES
Equals
SPECIAL MACHINE TOOL PERFECTION!

PRECISION BELT-DRIVEN SPINDLES OR WORKHEADS

In nearly 500 American and foreign plants, STANDARD spindles are doing a top production job as modernizing applications on old machines, and in special adaptation for custom jobs.

GOT A TOUGH PROBLEM?
Our custom engineering department has or will get the answer for you. Tell us about it today —you'll get RESULTS that mean LOWER COST— GREATER PRODUCTION!

Write for free literature today.

Since 1912

the STANDARD electrical tool co.

PRECISION SPINDLES AND MACHINE TOOLS

2478 RIVER ROAD • CINCINNATI 4, • OHIO

Encircle No. 227 on card opposite page 86

heating or checking of the work pieces is a feature of this machine. The segmental wheel, according to the manufacturer, actually rips off metal at a rate never before achieved with abrasive wheels.

These new machines have the additional features of Patented Belt Covers to fully protect the machine ways from dirt, vapor and grit. The cross feed mechanism is both manual and automatic. Automatic in-feed is by a hydraulically driven cam actuated device with graduated dial and can be adjusted from .00025 to .006 per table stroke. Coolant systems are motor driven. Machine weights range from 20,000 up to 65,000 pounds, dependent upon size and capacity.

Use HANDY Card, opposite page 86. Encircle No. 112

Bullard's New Coping Wheel

The George H. Bullard Co., Inc. Dept. FAG, Westboro, Mass., announces a new coping wheel which they claim to be an outstanding improvement in the industry.

This "Safe-Center" coping wheel retains all the strength of the old style heavy steel center type, yet by elimination of the heavy steel plate, lessens the weight by approximately 50%.

The cutting rim becomes an integral part of the wheel, which greatly increases the safety factor. This permits

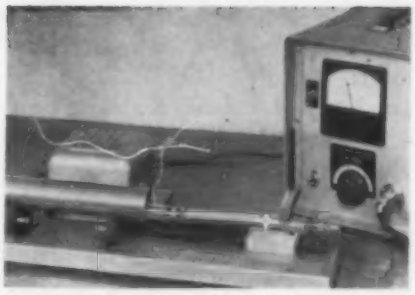
two full inches of usable cutting material.

In addition to greater safety, this "Safe-Center" coping wheel saves up to 50% in operating costs and does away with the old inconvenient practice of wheel returns. The new Bullard "Safe-Center" coping wheel is discarded when worn out.

Use HANDY Card, opposite page 86. Encircle No. 113

New Pilotor Provides For Profilometer Measurements

Micrometrical Manufacturing Co., announces the Type RF Cylinder Pilotor, for taking Profilometer roughness measurements around the circumference of tubing, round bar stock, and other cylindrical pieces.



The piece to be measured is placed on two pairs of rollers, as illustrated. One roller is driven by belt from a constant-speed motor in the housing, and rotates the work at a surface speed of 0.3" per second. The roughness measurement is made by a Type LA Tracer. The Tracer is supported by a Linkarm, and remains stationary while the work rotates beneath it. The Linkarm is attached to a vertical post on a horizontal slide, to permit adjusting (1) the height of the Tracer, for different work diameters, and (2) the lengthwise position of the Tracer, for measuring at different locations along the work

The equipment illustrated provides for measuring around ID's as small as ¾" and around OD's from ¾" to 3½", and provides a 7¼" lengthwise adjustment of the Tracer position. Minimum length of work accommodated is 2½", and maximum recommended length is 12". Micrometrical Mfg. Co., Dept. GF, 345 S. Main St., Ann Arbor, Mich.

Use HANDY Card, opposite page 86. Encircle No. 114

SANFORD
SURFACE GRINDER
MODEL MG

For Dry or Wet* Grinding!
PRECISION • SPEED • SENSITIVITY

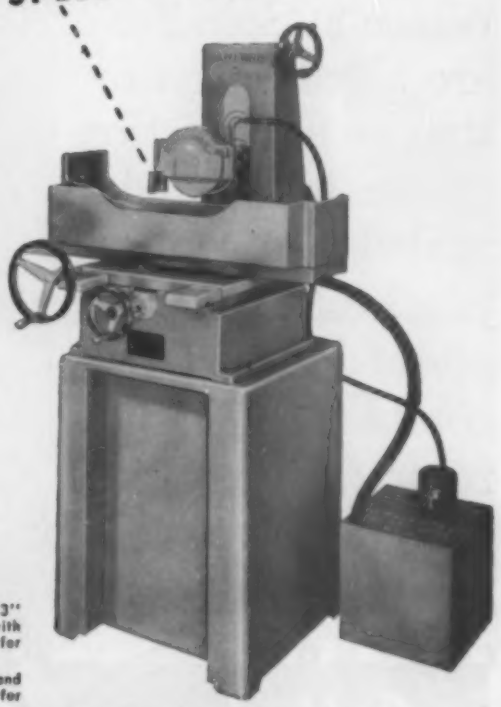
Built by manufacturers who concentrate on small grinders only, each Sanford Grinder is an individual project of time tested and proved basic design. Although modest in price, no quality undermining shortcuts are employed to reduce manufacturing costs. Constant repeat orders prove its acceptance.

This sensitive machine grinds to micro-inch accuracy with no vibration, with maximum dimensional stability. Here's why:

- Transverse ways are double Vee (VV) Meehanite inserts instead of flat surfaces which depend upon unstable jibs for alignment and accuracy.
- Needle, Ball and Oilite Anti-Friction bearings are used throughout.
- Alignments are electronically checked for accuracy.
- Precision slides are ground, lapped and hand spotted.
- Dials are large and legible.

SPECIFICATIONS — 8¾" transverse—13" longitudinal—12" vertical under 7" wheel with Adapter. Approximate weight 630 lbs. Send for illustrated bulletin.

Replacement parts, special attachments and reconditioning facilities are available. Send for price list.



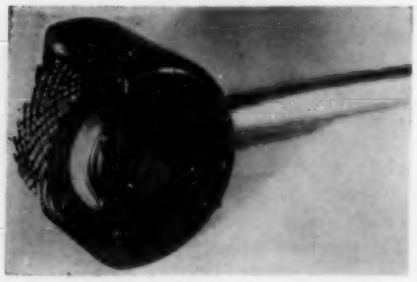
*With optional equipment

SANFORD MANUFACTURING CORP.
1026 Commerce Ave. Union, N. J.

Encircle No. 243 on card opposite Page 86

New Ball Bearing Wheel Dresser

A new precision ball bearing mechanical wheel dresser recently announced by Aer-O-Matic Tool Co., 5059 W. Diversey, Dept. G, Chicago, Ill., has close to 30% more width.



A 2⅜" outer diameter and 17, sixteen gauge cutter discs results in a longer life to the dresser with better grinding and less dressing. There are 29 cutter teeth per cutter with a full ⅜" teeth length. Shafts are a larger diameter to give more rigidity. The ball bearings are a single Neoprene sealed type, mounted so the sealed side is exposed. This is an absolute seal. Preload is set on the bearings at the time the units are assembled and it is not necessary to reset preload while in use. 10-15 micro finishes can be obtained with these dressers. There are three other types of spindle units available with the same features for any type grinding application. They can be furnished with spacers where a grinding application requires opening a wheel further for more freeness in cutting action. Holders for the spindle units are available for any type grinder.

Use HANDY Card, opposite page 86. Encircle No. 115

Vulcan Rotary Table for Surface Grinders

Vulcan Tool of 730 Lorain Avenue, Dept. G, Dayton, O, announces the successful application of a rotary table for surface grinders.

The Vulcan Rotary Table uses regular air line sources for power and attains variable speeds of 40 to 100 RPM. The table is an inexpensive portable attachment for the surface grinding of flanged studs or bushings, bearing spacers, forming rolls, (angle or radius), convex or concave surfaces, flush pin gages, punches or dies (radius or angles).

Tables 6" and 10" diameter are available. Only the machine cross feed is used, reducing machine error and producing time saving precision grinding or fine micro finishes on tool or production items.

Such a table can be used on a sine plate or angle fixture utilizing a standard surface grinder wheel, eliminating the dressing of large expensive external wheels for side grinding.

The table can be used with standard permanent magnetic chucks or simple fixtures to suit the part. Vulcan also is

Vulcan Rotary Table with permanent magnetic chuck, grinding for thickness. Also grinding a ½° taper for cutting relief.

Operators of Brown & Sharpe Grinders get ~~better~~ BEST production when modernized with Whitnon Spindles

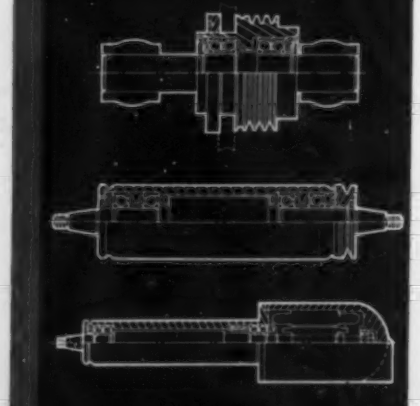
Whitnon Spindles are ~~better~~ BEST because they're anti-friction grease lubricated, sealed at assembly, precision balanced on own bearings, completely interchangeable, designed to fit present wheels

Equip your present or new Grinders with WHITNON SPINDLES — they're made to last longer

Write today for price and prompt delivery.

Now stocked for

#1, 2, 3, 4 and #11 Universals
#2 and 5 Surface Grinders
#10 and 13 Cutter Grinders



THE Whitnon MANUFACTURING COMPANY

ROUTE 6 & NEW BRITAIN AVE., FARMINGTON, CONN.

SPINDLES AVAILABLE FOR OTHER TYPES OF MACHINES

Encircle No. 228 on card opposite Page 86

The table top revolves at variable speeds —40 to 100 rpm. The center dowel or raised portion eliminates regular surface grinding. Side wheel grinding is expensive with poor accuracy and finish. The surface grinder table is locked. With the rotary table revolving, the front to back feed is used.

producing lapping plates for the conversion of the Table into a portable or bench type lapping machine. By mounting the lapping plate on top of the rotary table an inexpensive lapping machine is available for use any where in the tool room.

For close tolerances on valve plates, seal plates or other surfaces requiring smooth surfaces or micro finishes, Vulcan offers a dual purpose portable machine for lapping as well as a powered rotary table for grinding operations.

Use HANDY Card, opposite page 86. Encircle No. 116

New Brushing Lathe

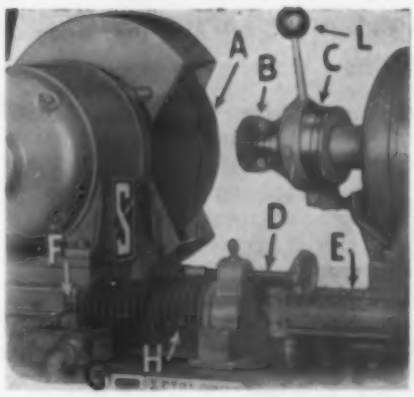
The Standard Electrical Tool Company, Dept. GF, Cincinnati, 4, O., announces development of an Automatic Cycle High Production Brushing Lathe.

Designed primarily for deburring both face edges of gear or sprocket teeth simultaneously with the use of two 12″ diameter brushes spaced for contact with opposite radii of the gear. Suitable for work from 3″ to 10″ diameter.

The operation is identified by the Legend in the illustration. The operator loads the work "B" on chuck mandrel "C" with right hand; actuates lever "L" with left hand; moves right hand from work area to actuate starting lever "H". Wheel head on anti-friction traverse "H" powered by cylinder "E" brings wire brushes "A" into work "B"; "G" actuates Timer for dwell; switch "F" controls motor; "D" is adjustable traverse stop to compensate for wheel wear.

Floor space 50″ x 23″, overall height 49″, height to spindle 39″, net weight 1040-lbs.

Single work head is shown. Also available with twin work head at



right for alternate wheel head traverse-contact.

Use HANDY Card, opposite page 86. Encircle No. 117

ROTO FINISH
your new opportunity in
controlled precision finishing
Roto-Finish processes are controlled precision finishing operations using low cost mass production techniques, which maintain exact tolerances on most any size or shape precision part with no significant dimensional changes. Roto-Finish speeds production, cuts maintenance expense, minimizes operational costs, yet produces top quality finishing results. Roto-Finish offers latest in controlled methods, materials and special purpose fixture equipment. Roto-Finish is your new opportunity in controlled precision finishing with guaranteed results!
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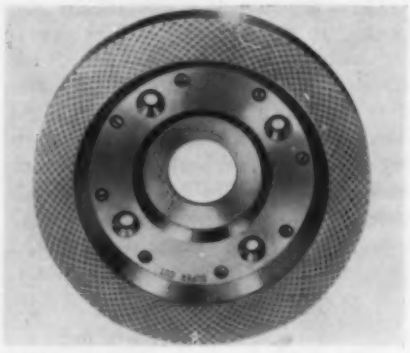
Phone 3-5578

visit our booth | No. 394 at Industrial Finishing Exposition, June 20 - 23 at Cleveland Public Auditorium

Encircle No. 229 on card opposite Page 86

Controlled Spacing of Diamonds On New Wheel

Super-Cut, Inc., Dept. GF, Chicago announces a further basic development in their single layer wheel; scientifically "controlled spacing" of the diamonds in the single layer so as to produce the most efficient cutting pattern possible. This spacing, as shown in the illustration, places each diamond in a predetermined pattern that numerous tests have proven increases the cutting efficiency and grinding speed of the diamond wheel. The new "controlled spacing" process also assures positioning of each diamond in one plane. **That means that every diamond is working at its full efficiency.**



Super-Cut officials claim when used properly, the new wheel produces finished ground tools at 50% less then the lowest priced conventional multi layer diamond wheels.

This wheel employs an exclusive patented nickel bonding process to position each diamond accurately and to hold it in place tightly.

Use HANDY Card, opposite page 86. Encircle No. 118

New No. 11 Face Grinder

Brown & Sharpe Mfg. Co., Dept. GF, Providence, R.I., announces a new face grinding machine, having the work spindle in a horizontal plane, permitting wide flexibility of work-holding devices. The work rotating in a vertical plane results in easy cleaning of the work holding surface, effective coolant application and extremely high surface quality of the work being ground.

Grinding with the periphery of the wheel, this machine will produce accurate, flat surfaces on work up to 10″

diameter and up to 3″ thick, on a permanent magnet chuck (4¾″ with Face Chuck Attachment). Accurate concave or convex surfaces up to 10° are ground as flat surfaces.

Wheel truing by the set-diamond method is another feature. During the wheel truing operation the relative position of the finished face of the work piece to the diamond remains unchanged.

Also, the flexibility of work holding permits use of fastest and best method for insertion and removal of work from the machine. The horizontal work spindle allows use of lever-operated devices such as the permanent magnet chuck or face chuck.

The wheel slide grinding and truing speeds are selected and set, with graduated dial indicating rate in use at all times. This is equally true of the work feed. Automatic workfeed can be set for the inside and outside reversal or the inside reversal only. Similarly the dwells from 0 to 2½ seconds are independently variable at the inside or outside or both. All these controls are conveniently grouped.

A positive stop provided for both manual and power feed of the work head is particularly valuable for accurate sizing. Choice of manual or semi-automatic control, accurate wheel spindle slide reversal, sealed lubricated

Industry required a 48-inch diameter Rotary Permanent Magnetic Chuck. O. S. Walker Company, Inc., Worcester, Mass. responded by designing and building this permanent chuck, the world's largest—and larger sizes are now available. Where accuracy and positive parallelism are required WALKER design guarantees quality controlled dimensional standards. Whatever your holding problems—magnetic or vacuum—Walker engineers have the answer. They are as close to you as your telephone—Worcester, Mass. PLeasant 6-6293.

Encircle No. 230 on card opposite Page 86

spindles and automatic lubrication are other time and cost saving features.

Accuracy of sizing is attained through the workfeed mechanism, similar to that employed in our new Universal Grinding Machines.

With the machine equipped with the Workfeed Handwheel Power Retraction Arrangement (optional) simply turning a knob shuts off the collant and returns the workfeed handwheel, work head and grinding wheel to the work loading position. The Automatic Cycle and Spark-Timing Arrangement (optional) which includes the Workfeed Handwheel Power Retraction Arrangement, automatically controls spark-out time. Operating at a predetermined rate, it permits fast, accurate grinding with less experienced operators.

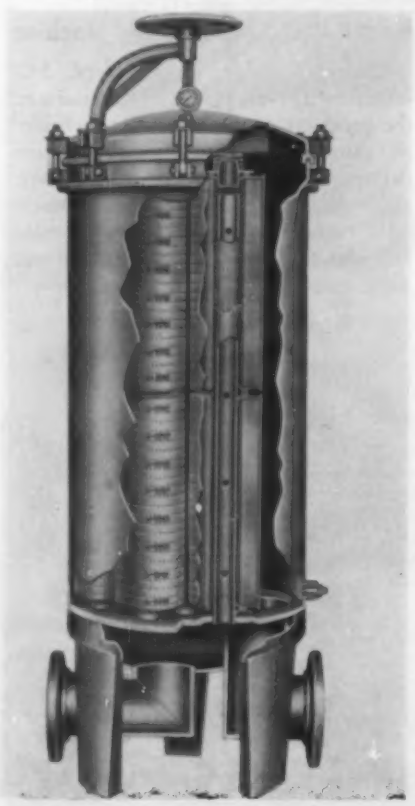
The No. 11 is suited to face grinding operations in the automotive, aircraft engine, gear, pump and cutter and tool fields where high surface quality and precision are required.

Use HANDY Card, opposite page 86. Encircle No. 119

New Full Flow Filters

A new line of Honan-Crane Full Flow Filters offering flow rates up to 900 GPM has been introduced by the Filtration Division, Houdaille-Hershey of Indiana, Inc., 26 South Ave., Lebanon, Ind. New units can be used for filtering engine lube and fuel oils, metalworking oils and coolants, and parts washing solutions.

Nine different sizes are available using one to 36 cartridges. (Shown is cutaway view of 12-cartridge model.) Flow rates range from 25 to 900 GPM. Pressure drop across unit is 4 PSI on oil of 170 SUS operating viscosity. Resin-impregnated pleated paper cartridges has 44 square feet of filtering surface.



A permanent neoprene gasket seals cover tightly to filter tank. Cartridges are sealed by a removable hold down cap; spring on cap compresses when cover is closed to prevent bypassing.

Use HANDY Card, opposite page 86. Encircle No. 120

New 6" Portable Grinder

Recently announced by The Black & Decker Mfg. Co. of Towson, Md, is a new 6" Portable Grinder whose power has been upped 85% over that of the previous model through the introduction of a new motor. Tool weight has been reduced 1½ lbs.

The 6" Portable Grinder is designed for continuous duty, incorporating lubricant-sealed ball bearings. Its heat-treated helical gears give a smoother and more efficient transmission of power from motor to spindle. A new type centrifugal fan produces extreme air velocity through the commutator section, permitting the motor to "run cool". Further, this strong air flow keeps the motor almost entirely free of abrasive dust and carbon. Exhaust air is directed away from the operator.

The grinder measures 24½" overall, weighs 18¼ lbs. net, and has a spindle speed of 3750 R.P.M.

Use HANDY Card, opposite page 86. Encircle No. 121

THE **Di-Profiler**

RECIPROCATING HAND MACHINE

for time-saving cutting—roughing—finishing

on jobs like these
Internal holes and irregular dies
Convex or concave surfaces
Tool edges
Internal or external tapers
Shoulders and recesses
Corners, small areas, grooves, fine details

Variable speed and stroke
Fast, precise, no vibration

An indispensable labor saver for die, tool and mold work, the Di-Profiler has a controlled stroke variable from 0 to 6 mm (¼ inch) and a speed of reciprocation adjustable from 0 to 100 strokes per second.

The Di-Profiler is rapid, precise, easy to operate—simple and sturdy in construction. Its weight of less than one pound and freedom from vibration eliminate fatigue and assure perfect control for the most intricate work.

Moderately priced, the Di-Profiler pays for itself many times through time-saving cost reductions.

Write for free demonstration or illustrated price list DG-555

Tools for every type of work
CUTTERS, FILES, DISCS, POINTS, BURRS, LAPS, SCRAPERS

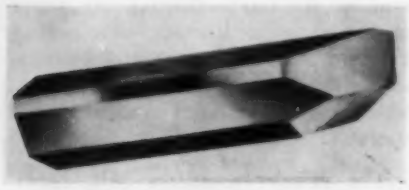
ENGIS EQUIPMENT COMPANY
Sole Authorized Distributor for the United States
431 S. Dearborn Street, Chicago 5, Illinois

Encircle No. 231 on card opposite Page 86

Diamond Holding Alloy Prevents Loose Diamonds

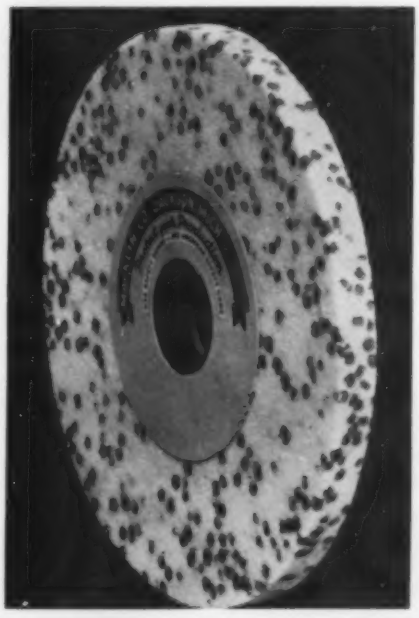
After years of experimentation and development, the American Coldset Corp., claims it has perfected a new diamond holding formula which they have named "m-28". Combined with an exclusive setting process, the new alloy guards against diamond loss even under the most difficult operating conditions. American Coldset now guarantees free replacement of any new shape tool should failure of setting occur. Form tool users engaged in jet bucket blade grinding have found the new Coldset tools especially valuable. American Coldset Corporation, 87 Court St., Paterson, N. J.

Use HANDY Card, opposite page 86. Encircle No. 122



New M M Process Wheels

The M M process wheel made exclusively by Macklin Company, Dept. GF, Jackson, Mich., is now available for jobs requiring Aluminum Oxide abrasive.



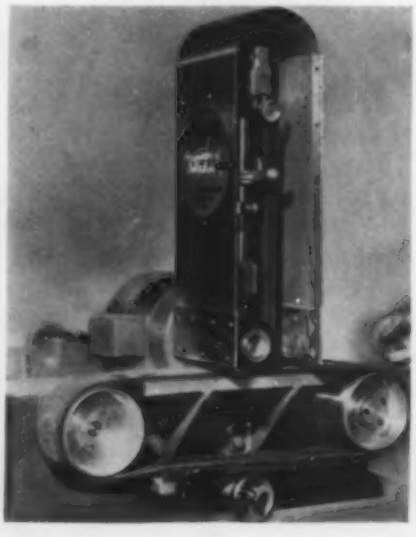
Fine grain in pellet form, distributed throughout the wheel, gives a constant flow of fine abrasive between the wheel and the work. The resulting self dressing action saves time and money. Because of this self dressing feature, a particular grade is adaptable to a wider range of materials.

M M is also being applied to internal and external grinding as well as surface grinding.

Use HANDY Card, opposite page 86. Encircle No. 123

Model 304C Conveyorized Machine

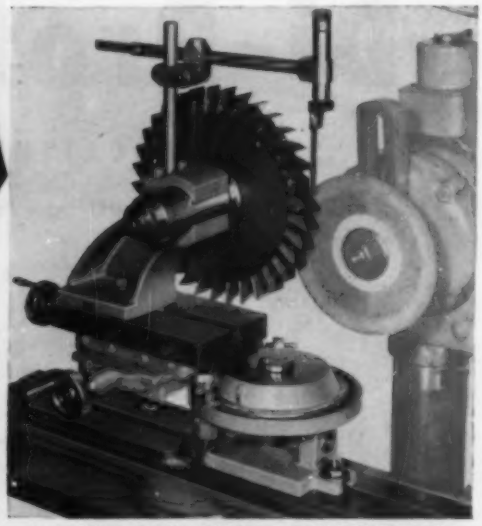
Curtis Machine Corp., Dept. FG, Jamestown, New York, has announced the production of a small conveyorized all purpose grinding, polishing, and deburring machine. The bench type, abrasive belt machine (Curtis Model 304C) can handle all types of material and provides high production possibilities at low equipment cost.



THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)

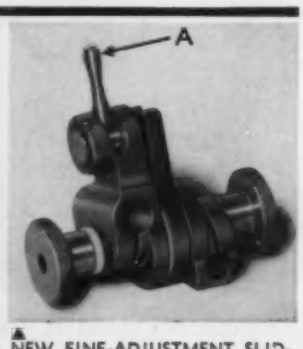


▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 602

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

Encircle No. 232 on card opposite Page 86

The carrier plate revolves between opposed grinding wheels, and .010" stock is simultaneously removed from each end of the pins in one pass. Finish ground pins are unloaded automatically through a chute into tote boxes.

Sizing devices continuously gage accuracy of the work. When wear on faces of the grinding wheels is such that pins approach the high limit of the tolerance, the automatic feed is actuated. This compensates for wheel wear, and permits only spot-checking of pieceparts for size and squareness.

Production is 2100 piston pins per hour, gross.

The drive motor for the conveyor belt is an infinitely variable speed, 3 to 1 ratio, one-third HP motor, permitting complete flexibility for various types of work. The drive motor for the spring tensioned coated abrasive belt is one and one-half HP and drives at 3600 RPM. The 4 inch wide, 54 inch belt can be changed and tracked in a few seconds. A hand wheel at the front of the machine adjusts the grinding head for variations in stock thickness and regulates the grind pressure.

Multiple grinding heads for rough to finish grinding operations can be provided at a low additional cost.

Use HANDY Card, opposite page 86. Encircle No. 124

Air-Inflated Grinder

Development of interchangeability in Nu-Matic air inflated Aircore grinding wheels has been announced by Nu-Matic Grinders, Inc., Dept GF, 8224 Carnegie Ave., Cleveland 3, 0.

The Nu-Matic principle is based upon a rubber drum fabricated in

much the same way as a tubeless tire. The "tire" is fitted tightly upon a core assembly, which is turned by the grinder shaft. While the rubber wheel is deflated, the grinding operator fits an abrasive band over the outer surface. The rubber drum is then slightly inflated with air to whatever hardness is required by the operation.

Previously, core sizes have varied from model to model. Now it is planned that a user may order drums of whatever specifications he requires without having to order special cores. The new Model 525 and the forthcoming Model 630 both conform to this new design principle.

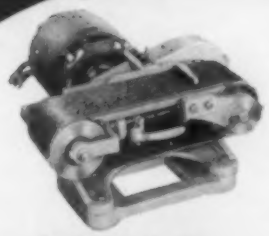
Aircore drums will be standardized to fit standard cores enabling users to stock a complete line of wheels for a single core. Production of a new model designated 525 which has been designed around the Nu-Matic principle, but which features marked improvements in balance, operating speed and lightness was also announced.

Use HANDY Card, opposite page 86. Encircle No. 125

We buy surplus diamond wheels and tools, also diamond wheel stubs and sludges. Highest prices paid.

NATIONAL DIOCHEMICAL COMPANY
3106 W. LAKE ST. CHICAGO 12, ILL.

DOES IT BETTER
DOES IT FASTER



SIMPLEX-M
ABRASIVE BAND GRINDER

The precision of a machine tool plus the durability of a workhorse. Complete with ½ H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

WALLS SALES CORP.
333 Nassau Avenue Brooklyn 22, N. Y.

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DIAMOND WHEELS and TOOLS AVAILABLE NOW!

ALL TYPES
ALL SIZES
ALL BONDS

Do you have a problem? Let us help you solve your diamond problems. A complete engineering service backed by years of practical diamond experience is available from this organization . . . so write us today. No obligation.

RALPH WATKINS INTERNATIONAL TRADE
2251 East 75th St. Ph. RE 4-2363 Chicago 49, Ill.

Encircle No. 234 on card opposite Page 86

PRESSURELOK-224
RESINOID DIAMOND WHEELS
— the best diamond wheel bond ever developed —
if you've used them - you know they're best!
if you haven't - let us show you!
UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.

100,000 RPM Pencil Grinder

A 100,000 RPM "Nu-Jett" Pencil Grinder that operates with "finger-tip" control is announced by Jerico, Dept. GF, 4744 W. Lake St., Chicago.

Not much larger than a pocket fountain pen, it will operate on air pressures of 50 pounds or more. It is accurate and easy to control and its high speed and compact size make for fast work on metal, wood, plastic or glass.

The complete unit consists of the grinder, six feet of nylon reinforced hose and a new-design filter-lubricator which insures clean air by accurately metering oil in mist form directly to the air stream. Should capillary action fail due to fouling, syphoning action automatically takes over to deliver oil.

The filter-lubricator also may be obtained separately for use on all types of small air tools and cylinders.

Use HANDY Card, opposite page 86. Encircle No. 126

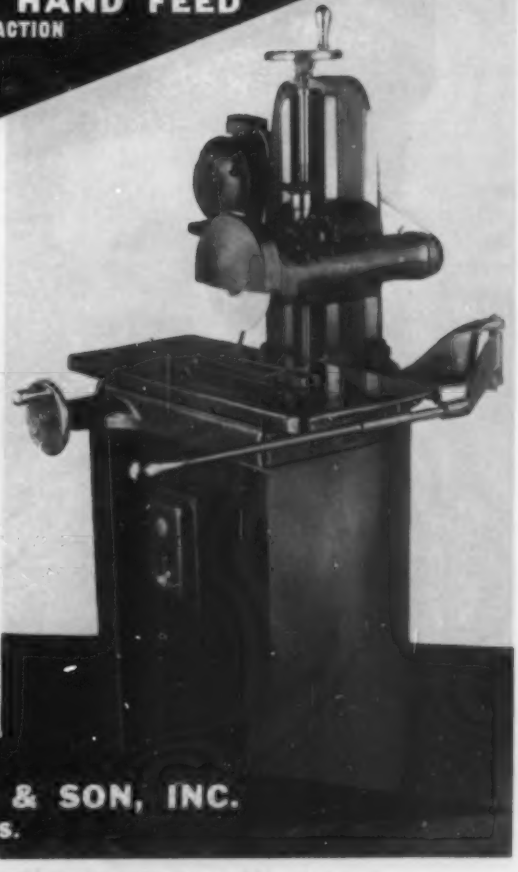
Blue Flash "BF"

The Blue Flash "BF" raised hub disc-wheel, Bay State's newest portable

"T" CROSMAN'S HAND FEED
T-SQUARE ACTION
SURFACE GRINDER

Accurate and speedy grinding of tools, dies and small machine parts is now possible with Crosman's "T" Surface Grinder. Production and odd-job grinding costs can be cut . . . as the Crosman can be quickly set-up and made ready-to-go.

Features include hand feed, precision taper bronze bearing with ball thrust, chrome plate spindle. Completely wired, ready to plug in . . . drive: 1/3 single phase capacitor or polyphase motor. Occupies floor space of only 44"x32". Full informative folder. Send for yours today.



WRITE FOR CIRCULAR
J. B. CROSMAN & SON, INC.
EAST WALPOLE, MASS.

Encircle No. 235 on card opposite Page 86

Encircle No. 236 on card opposite Page 86

grinding wheel development, delivers substantial increases in cutting speed.

Changes, designed to take maximum advantage of the cutting ability of each abrasive grain, permit them to penetrate deeper and take bigger "bites" of metal.

This "sharpness" also exists on the entire underside of the wheel, permitting easy grinding and blending of external corner welds and convex surfaces.

The wheel has been designed for all weld grinding and portable cutoff applications found in metal fabricating plants and foundries.

Wheel specification A-24R-BF, is available in the popular 7" and 9" diameters, thickness ⅛", 3/16" and ¼".

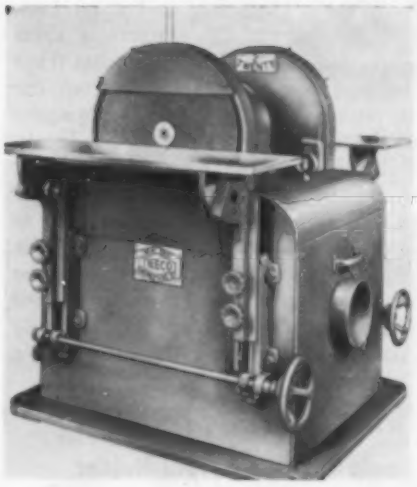
Bay State Abrasive Products Co., Westboro, Mass.

Use HANDY Card, opposite page 86. Encircle No. 127

New High In Abrasive Speed

Through the development of a special method of processing abrasive coated cloth discs, New Era Engineering Co., 458 West 29th Street, Chicago 16, Ill., has produced a grinder which operates at a perimeter speed of more than 18,000 feet per minute.

Known as the Neeco-2-Twenty Abrasive Coated Cloth Disc Grinder, the new unit is a twenty-inch diameter



double disc machine. It is powered with a special 10 h.p. motor, fully adequate to handle heaviest material removal loads without reducing disc speed. It is direct driven, and supplied in 220 or 440 volts, 60 cycle.

When both rapid material removal and fine finish are required the use of coarse grit abrasive on one disc and fine grit abrasive on the other disc will accomplish this efficiently and economically.

The grinder is also designed to house its own dust collector within the machine itself (as optional equipment).

Use HANDY Card, opposite page 86. Encircle No. 128

use STRIPS of abrasive at 1/4 the cost

End the bother and high cost of endless abrasive belts by using strips torn from standard economy rolls on . . .

CONE-LOC® DRUM SANDERS

Many plants claim they save the entire cost of CONE-LOC DRUM SANDERS on the first 50 yards of abrasive used!

When the arbor nut is tightened down against locking cone the wheel becomes a perfectly balanced, smooth running drum . . . with no bounce at the joint. Can be re-headed with new abrasive strip in seconds. Can be used on either flexible shaft or stationary arbor.

- SAFE *at speeds up to 4000 R.P.M. (6¼" diameter)*
- PRECISION BALANCED *at operating speeds*
- LIGHT WEIGHT *Now made of new "high tensile" aluminum alloy.*

SATISFIED USERS who have RE-ORDERED: Enterprise Plating Works, Excello Corp., Caterpillar Tractor, Thompson Products, Chrysler Corp., Fisher Body, Remington Arms, and many others.

Standard RUBBER CUSHION Sizes (Durometer: 40 - 50)			
Diam.	Widths	Net. Wt. Lbs.	Delivered Price
6¼"	1"	1½	$24.75
6¼"	1½"	2	27.25
6¼"	2"	2½	29.00
6½"	3"	3¼	37.50
8 "	2"	3½	40.00
10 "	2"	6	48.00
12 "	2"	7½	58.50
Standard FELT CUSHION Sizes			
6¼"	1"	1¼	$21.00
6¼"	1½"	1¾	22.75
6¼"	2"	2	24.75

Specify arbor hole size—½" to 1¼"
All Prices Are DELIVERED Your Plant

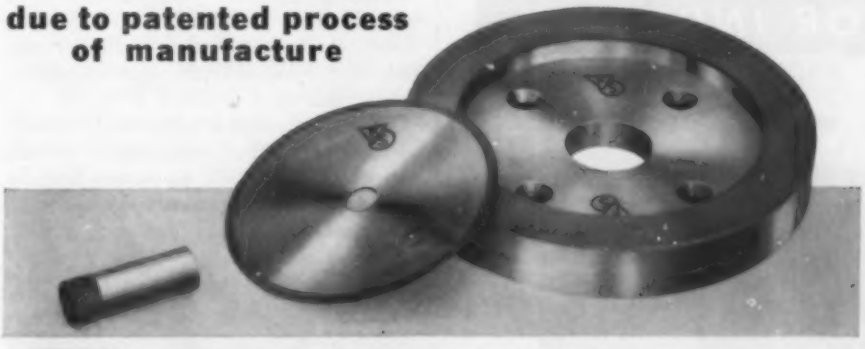
ORDER TODAY through any industrial distributor or direct — Immediate Delivery

AMERICAN DIAMOND SAW SALES
120 N.W. Ninth Ave. Portland 9, Oregon

Encircle No. 238 on card opposite Page 86

FASTER CUTTING . . . LONGER LASTING

due to patented process of manufacture



FS TM REG.

STEELSET Diamond Wheels

(for wet grinding)

Attractively priced

•

Fast delivery

•

WRITE FOR CATALOG DT353

Made by a superior patented process, FS STEELSET Diamond Wheels have exceptionally fast cutting properties. Grinding costs are halved. They have excellent non-glazing and non-burning characteristics, coupled with remarkably long life—as much as five times greater than resinoid or vitrified bonds.

Produced by a hot-press powder metallurgical method. The diamond particles are coated by high vacuum technique to insure extra strong gripping action by the sintered steel bond. This prevents their premature pulling out of the metal matrix.

In many types for a wide variety of applications.

Drills, blades, hones, lens laps, central laps, etc.

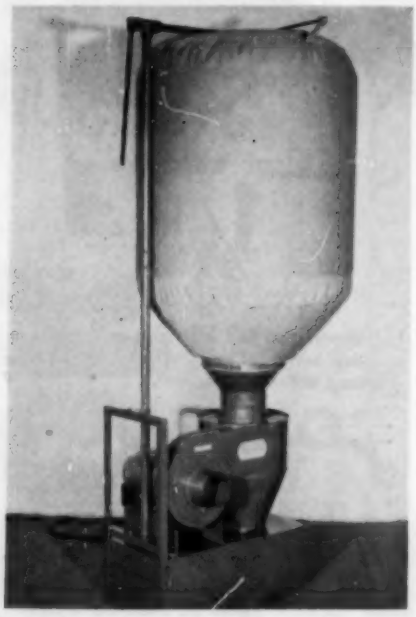
FISH-SCHURMAN CORP., 81 Portman Rd., New Rochelle, N.Y.

Encircle No. 237 on card opposite Page 86

New Dust Collector

A new dust collecting unit, developed to eliminate problems where fine and coarse dust must be simultaneously collected, has been announced by Aget Manufacturing Co., Adrian, Mich.

Designated as the Dustkop 5C20, it combines a cloth bag and a mechanical preseparator. It features a cloth filter bag of large filter area that traps the fine dust not separated from the air stream by the centrifugal action of the cyclone separator. A single upright supports the filter bag for easy installation in the field, and a shaker handle imparts a snapping action to both sides of the cloth filter bag for effective removal of dust from the inside surface. Fine dust then falls freely into a single dust bin with the coarse dust, contributing to simple "one action" emptying.



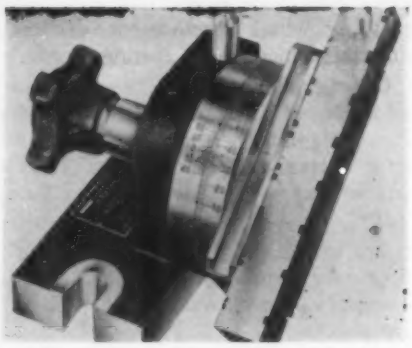
Use HANDY Card, opposite page 86. Encircle No. 129

Angle Dresser & Tool Holder

The Rothfuss G-2 Angle Dresser and Tool Holder is a versatile tool that embodies all elements required for angle trueing wheel dressing service or serves as an efficient, accurate tool holder.

As an angle dresser the Rothfuss G-2 has a graduated easy-to-read vernier scale (0 to 180 degrees.) that can be set to within 5 minutes of 1 degree in seconds.

It can be set quickly to any clearance angle desired without wrenches and holds tool bits up to 1" square maintaining close tolerances throughout angle grinding, form grinding and other operations.



Manufactured by Rothfuss Tool Co., Dept. G & F, Box 202 Elmwood Station, Providence 7, R.I.

Use HANDY Card, opposite page 86. Encircle No. 130

Slot Grinder Attachment

Enclosed contours, including sharp corners, key slots and other forms, can be ground on the No. 2 Moore Jig Grinder with a horizontal-spindle slot grinder attachment, now available as an accessory from Moore Special Tool Co., Dept GF, Inc., of Bridgeport, Conn.

The slot grinder can be substituted for the vertical-spindle grinding head to perform these operations, adding substantially to the capabilities of the machine.

Although the horizontal spindle axis is nominally normal to the travel of the outfeed slide, its rotatable mounting permits any other desired angular relationship. Such a requirement may arise because of obstructions in the contour which necessitate "cocking" the wheel, or because draft must be ground in the side of a slot.

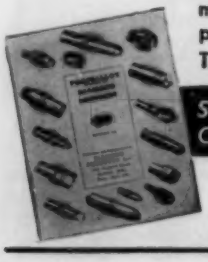
The attachment is motor and Vee-belt driven and takes unmounted wheels from ⅞" to 1½" diameter. Spindle speeds are approximately 18,000—22,000 rpm.

"PRESTALLOY" DIAMOND DRESSERS FOR INDUSTRY

The Diamond Products "PRESTALLOY" process assures greater diamond utility. This special mounting process offers today's lowest possible cost per dollar investment in diamond dressers.

The complete Diamond Tool Line offers these manufacturing features:

★ Advanced Diamond setting Process
★ Improved Matrix Process ★ Accurate Heat Control
★ Controlled setting pressure ★ Secure setting



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Representatives in Principal Cities

DIAMOND PRODUCTS, INC.

340 Prospect Avenue, Elyria, Ohio

Pioneering in Diamond Impregnated Products Since 1932

Encircle No. 239 on card opposite Page 86

Centerless Lapping Machine

The centerless lapping machines manufactured by Size Control Co., Dept. GF, 2500 W. Washington Blvd., Chicago 12, Ill., will provide finishes of 1½ microinches or less and tolerances of .000005.

Designed for lapping oversize bearings and gears; and lapping and sizing bearing races, shafts and cylindrical parts, the machines also eliminate special operating skills, costly set ups, ring laps and special tools.

The centerless lapping machine consists of two power-driven rollers. One is considerably smaller than the other. The smaller roller travels at a relatively slower surface speed and turns the piece being worked at a constant rate.

The larger roll is impregnated with lapping compound and rotates at a faster surface speed. The work piece is placed between the rolls and pressure is applied with a fibre stick. The cutting action of the rolls reduces the size of the work piece and can produce a finished surface of one and one-half microinches RMS or better.

The amount of pressure applied to the work piece governs the amount of stock being removed. This means that high sections will be lapped quickly by applying sustained pressure at those points and pieces which with shoulders may be lapped by allowing the shoulders to hang over the ends of the rolls.

A simple adjustment, to vary the space between the rolls, permits lapping any diameter from .003" to 10" with no time lost. Roll speeds may be adjusted to suit all requirements, and any standard lapping compound can be used.

Use HANDY Card, opposite page 86. Encircle No. 131

Don't Forget to mention GRINDING & FINISHING when writing advertisers, or use the handy Readers' Service card opposite page 86.

TIMESAVERS, INC.

announces
a new and versatile

GRINDING and FINISHING MACHINE

Featuring an automatic feed, quick change abrasive belt and a reasonable price; this amazing TIMESAVER machine will do outstanding grinding and finishing work on all types of flat stock, bars, square and rectangular tubing, sheets and plate. Most metals such as stainless steel, cold and hot rolled steel, aluminum, bronze and others have been handled with ease.

For further information
Write today

TIMESAVERS, INC.

P. O. Box L, Robbinsdale 22, Minnesota

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Finger-tip control at 100,000 R.P.M.!

NU-JETT GRINDER

from JERICO

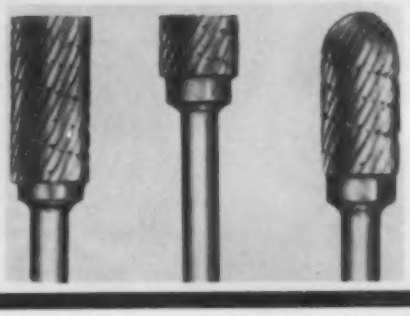
Giant power in midget size. For all grinding, polishing and etching operations. 100,000 R.P.M. gives sharp, burr-free lines. Triples the life of burrs and abrasive wheels. EXCLUSIVE safety cap. Especially valuable for marking aircraft parts. Air pressure 70 lbs. or more.

- *Also ask JERICO for free, full data on the new COLD-MOLD metal for molding grinding fixtures.*

JERICO "CHIP-BREAK" BURRS

Diamond-honed chip-breaking cutting edges prevent loading and burning plastics and soft metals. Solid tungsten carbide from cutting head to neck in 33 different shapes. Shanks 3/32" and 1/8".

- *Send for free technical literature on grinders, burrs and molding metals for fixtures.*



JERICO

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Encircle No. 241 on card opposite Page 86

News of the Industry

Product Responsibility for Man-Made Diamonds Eagerly Awaited by Industry

The recent announcement that General Electric scientists have produced man-made diamonds leaves many questions unanswered regarding the future industrial use of the diamonds.

Here are some questions foremost in the minds of industrial leaders:

1. Does General Electric plan to manufacture diamonds themselves, or will they eventually farm out the process?

2. What will GE do with the diamonds from a commercial standpoint?

3. When will product responsibility be assigned?

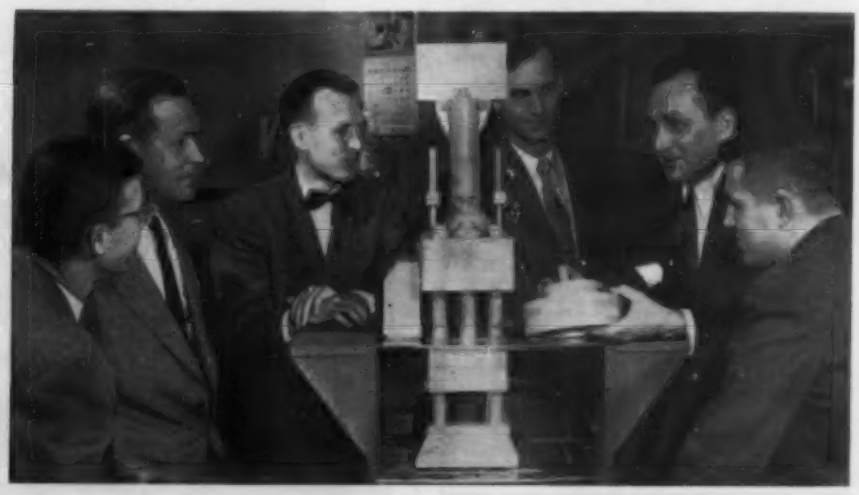
In reply to these questions, Miles J. Martin, manager of General Electric's research information service, told **GRINDING** and **FINISHING:**

". . . with reference to your questions regarding possible commercial applications, I can only say at the moment that the industrial problems related to commercial applications are under study. As yet, the product responsibility . . . has not been assigned. The project is still in the research stage, with a great deal of research and development ahead of us before we will be in a position to give a definite answer to your questions.

"The diamonds being made at present are of the sizes commonly used in grinding wheels, and it is expected that, if they can be produced in quantity and at a price, they will find application for industrial cutting, grinding, and polishing applications."

However, the fact that man has duplicated another of nature's substances has brought to industry the full realization that bigger and better developments are still ahead of us.

General Electric's diamonds may well be considered someday by industry as great a discovery as Alexander Graham



Bell's telephone or Thomas Edison's light bulb.

The diamonds are the result of a 125-year effort to duplicate nature's hardest and most glamorous substance. They are made from a carbonaceous material subjected to extreme pressures and temperatures. The largest stone, yet produced, measured 1/16 of an inch in the longest dimension.

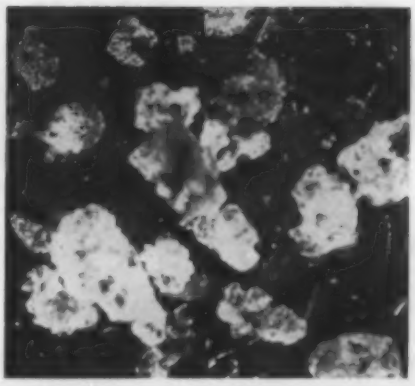
Dr. Guy Suits, G-E vice-president, has warned that "any conclusion we are about to make diamonds of a size and quality suitable for gem use is decidedly premature.

"On the other hand," he stated, "if the present high cost of making diamonds by the G-E process can be reduced, the primary application will probably be in industrial tools for cutting, grinding and polishing."

Diamonds are mined at the rate of about 2½ tons annually. Approximately 90% are imported by the United States. Of the diamonds of industrial grade, some are stockpiled for defense purposes, but the major portion goes into tools that cut, saw, grind, or polish other hard materials. For industrial diamonds purchased in a typical year, the U. S. paid more than $50 million.

Dr. A. L. Marshall, manager of G-E's Laboratory's Chemistry Department, said the duplicated diamonds were positively identified by x-ray inspection, chemical examination, and hardness tests. Under hardness, the diamonds proved capable of scratching anything, even other diamonds.

(a) This is the largest diamond yet made in the G-E research laboratory, by Dr. Herbert M. Strong, Physicist. About 1/16th of an inch in longest dimension, it has been photographed beside a standard, diamond, high fidelity phonograph needle to indicate its relative size.



(d) A photomicrograph showing diamonds made in the research laboratory by the Hall-Wentorf process.

The scientists directly responsible for the project were Drs. Francis P. Bundy, H. Tracy Hall, Herbert M. Strong, and Robert Wentorf.

In Dr. Strong's process, a carbonaceous compound was subjected for many hours to a measured process some 53,500 times greater than atmospheric (roughly 800,000 pounds per square inch). That run, in the laboratory's new 1000-ton press, yielded a crystal nearly a sixteenth of an inch in longest dimension.

"After opening the pressure chamber," said Dr. Strong, "and while attempting to polish the now solidified

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HERE'S A NEW SLANT ON
FAST ANGULAR SET-UPS
THE MAGNA-SINE
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ALSO PRODUCERS OF SPECIAL MACHINERY, GAUGES AND FIXTURES

Encircle No. 244 on card opposite Page 86

matrix, there appeared what we were seeking, a core of superhard matter that refused to wear away under the action of a polishing wheel. With considerable excitement and expectation I removed the crystal from its surroundings, and tried one of its sharp points on sapphire, silicon carbide, and boron carbide. This 'diamond,' I could call it now, easily scratched all three."

Also of fundamental importance was the work of Dr. Hall, who extended Bundy's initial high pressure work and developed the "belt," a chamber enabling the scientists to maintain for the first time temperatures above 5000 degrees farenheit at pressures in excess of 1,500,000 pounds per square inch.

This pressure is roughly equivalent to the "squeeze" physical scientists have computed for points 240 miles beneath the earth's surface. Using this equipment, late last year, Dr. Hall developed a process that produces diamonds in a matter of minutes. Hall's diamonds are somewhat smaller, but are often produced as solid clusters. Single runs have produced up to 1/10 of a carat.

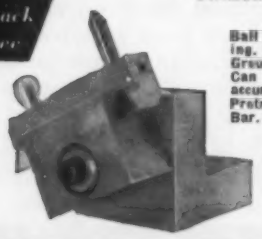
Dr. Wentorf likewise had success with the same physical apparatus employed by Hall, though different chemical conditions were present. Since these achievements, several new methods have been tried, and these also produce diamonds.

Get a better "SURFACE GRINDER" job at less cost

RADIUS DRESSER $39.00
DIAMOND $7.00

ORDER DIRECT on our 10 day money back guarantee

ANGLE DRESSER $44.00
DIAMOND $7.00



Ball Thrust Bearing. 24 Precision Ground Surfaces. Can be set very accurately with a Protractor or Sine Bar. Works underneath the wheel. Large Bearing surfaces.

Chatter Resistant, Spring Loaded Spindle

Hardened shaft—bearing adjustable for wear. Diamond always perfectly centered. Easily set adjustable 180° steps.
10" Wheel size for DoAll and NORTON Grinders—$44.00, Diamond $7.00.
SPECIAL 20" Wheel Size $110.00.

The "Mighty Midget" Line

SPERMAN METAL SPECIALTIES • 2197 E. 21st ST. • BROOKLYN 29, N. Y.

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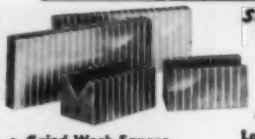
MAGNE-BLOX



SPEED SURFACE GRINDING SET-UPS WITH MAGNE-BLOX

- Grind Work Square
- Grind Work Parallel
- Hold Round Pieces
- Save your Magnetic Chucks
- Eliminate Clamps
- Eliminate Holding Devices

Laminated Parallels
V-Blocks & Angle Irons

UNIVERSAL SET
$22.25 In Case
Code GANBO

Write for Folder Code GINXA

RADIUS DRESSER

SPEED UP PRODUCTION with the "Little Wonder" RADIUS DRESSER

Better Support by using Swinging Arm pivoted on Lapped Centers, eliminating Vibration and giving Better Finish.

Dressing and Shaping Grinding Wheels up to 1" Convex or Concave Without Diamond
Code GANLE

$39.50

Natural Pointed 1/3 K. Diamond $6.50

Write for Illustrated Folder Code GINTV

GEORGE SCHERR CO., Inc. 200-GF LAFAYETTE ST. • NEW YORK 12, N.Y.

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The Bigger Difference Brings BIGGER TIME SAVINGS!

YOUR BRIGHTBOY DISTRIBUTOR CAN NOW FURNISH RUBBER-CUSHIONED *STOCK* ABRASIVES *MATCHED* TO JOB REQUIREMENTS!

These two widely-different Brightboy Wheels may *look* alike! Each has a wide and different application. *Either one could save you as much as 50% in finishing time!*

One of these wheels is compounded with SILICON CARBIDE, the other with ALUMINUM OXIDE. In *both grains* you have a wide selection of UNIFORM TEXTURES AND GRAIN SIZES RANGING FROM EXTRA FINE TO EXTRA COARSE, IN SOFT, FIRM AND TOUGH RUBBER BINDERS.

Multi-use Brightboy burrs, cleans, finishes and polishes in one operation. The precision finish frequently serves as the final polish. The unique action of rubber and abrasive, working together, gives you a completely new, wider concept of finishing!

Ask your dealer about Brightboy, and for the new Brightboy catalog. Advise us if he cannot supply you. Write us on any problem where finishing is involved.

WELDON ROBERTS Brightboy RUBBER CUSHIONED ABRASIVES

BRIGHTBOY INDUSTRIAL DIV.
WELDON ROBERTS RUBBER CO.
95 North 13th Street, Newark 7, N.J.

America's Pioneer Manufacturer of Rubber-Bonded Abrasives

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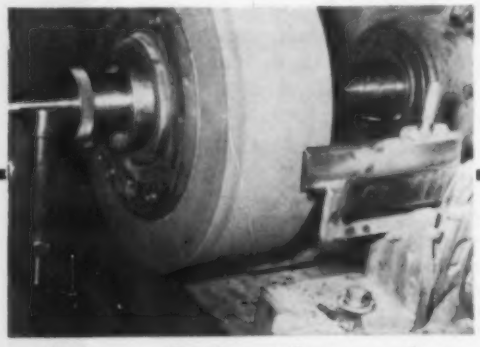

Precision Balancing of Grinding Wheels Made Easy

with the New Driver Portable Balancing Units

- ★ Saves up to 80% of time and labor on every balancing operation. No lifting.
- ★ Gives faster production and far greater precision on close tolerance grinding.
- ★ Ball bearing arbor attaches to spindle.
- ★ Wheel is moved onto arbor firmly locked in place and weights adjusted for balance.
- ★ Support at end of arbor for centerless and other heavy wheels.
- ★ Low in cost. Easy to operate. A unit is made for nearly every type of grinder. Wheel shown 6-20-12.

Send for Complete Information

CRESTLINE PRODUCTS, INC.
208 Paramount Bldg., Fort Wayne, Indiana

Encircle No. 280 on card opposite Page 86

Norton To Open West Coast Plant

A new plant for the manufacture of grinding wheels is being equipped and will be opened Jan. 1, 1956 at Santa Clara, Calif., by Norton Company of Worcester, Mass.

The one story plant at 2555 Lafayette St., 45 miles south of downtown San Francisco, was purchased last Fall. Intentions at that time were to convert

George A. Garrison

it into a warehouse. However, in the interests of providing better service to customers in the far west, it was later decided to set up manufacturing operations in the midst of the rapidly expanding West Coast Market. The new Norton plant, which will manufacture a full line of vitrified, organic and diamond wheels, will begin production late this year.

The new building contains 50,000 square feet of factory and office space. It is of modern construction, built in 1947, and was formerly used for textile operations by Fiberglass, Inc.

George A. Garrison has been named plant manager. He was formerly superintendent of packing and shipping at the Worcester plant.

Others who will assume management posts are **Lennert G. Jacobson,** office manager, **Fletcher G. Bevis,** accountant, **Duane Barnhart,** control engineer, **Frederick H. Mattson,** foreman of mixing, molding and firing, and **Martin T. Johnson,** foreman of finishing operations, packing and shipping. Only supervisory personnel will be taken to Santa Clara from Worcester.

APPOINTMENTS

Appointment of **N. Douglas MacLeod, Jr.,** as executive vice-president of Abrasive Machine Tool Co., East Providence, R.I., has been announced by the company's board of directors. His new duties will encompass supervision of company operations.

Douglas C. Lynch

Douglas C. Lynch, formerly executive vice-president of Brush Electronics Co., Cleveland, has been named president of the company. Mr. Lynch joined the company in 1952, having previously

N. Douglas MacLeod, Jr.

been head of the international operations of Crosley Division of AVCO Manufacturing Corp., and later a senior staff executive of Willys-Overland Motors, Inc.

The Arter Family of Machines

CARBIDE TOOL GRINDERS

CYLINDRICAL GRINDERS

INTERNAL GRINDERS

ROTARY SURFACE GRINDERS
Chuck Capacity 8" to 40"

The Arter trademark on these machines is the sign of
ACCURACY • POWER • DEPENDABILITY.

Tell our engineers your grinding problems. They'll find a way to lick them

ARTER GRINDING MACHINE COMPANY
WORCESTER • MASSACHUSETTS

Agents in industial centers of United States and Canada

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·Precision Lapping
·High Production
·Low Cost
SPITFIRE
precision
LAPPING MACHINES

FLAT LAPPING
Designed for accurate lapping any material where a perfectly flat surface is important. Finishes to extremely close tolerances are produced.
The perfectly flat surfaces of sliding and rotating parts, air and liquid tight seals, plastic and die casting molds are quickly accomplished with this machine tool.
Available in 18" and 24" Models.

SPITFIRE
ROLLER LAPPING
MACHINES
Save 2/3 in lapping time
For cylindrical lapping producing a finish as fine as a 2RMS or less and faster than any other method. Ideal for Plug Gauges.
WRITE FOR BROCHURES, PRICES AND DELIVERY
SPITFIRE
TOOL COMPANY
2933 N. PULASKI ROAD
CHICAGO 41, ILLINOIS
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Carborundum Acquires Curtis Machine Corp.

The Carborundum Co., Niagara Falls, N.Y., recently acquired the Curtis Machine Corp., which was a wholly-owned subsidiary of Lincoln Park Industries, Inc. Carborundum exchanged 8696 shares for the entire capital stock of Curtis Machine.

Gene DeMambro, president and general manager of Curtis Machine, will continue in that capacity, reporting to William H. Wendel, vice-president in charge of Carborundum's Coated Abrasives Division in Wheatfield, N.Y.

Curtis Machine, operating in Jamestown, N.Y., since 1913, pioneered in the manufacture of belt sanders and rubbing machinery for the furniture industry. For the past 10 years the company has developed many new machines introducing the principle of abrasive belt grinding in the metal industry.

Grinding Wheel is Most Effective Tool

Buffalo, N.Y.—Millions of tiny grinding points make the modern grinding wheel one of the most effective tools of industry. Research engineers of Electro Refractories & Abrasives Corp., estimate there are some 1.5 million abrasive points applied per second by a resinoid tool room wheel of 60-grit grain with an eight-inch diameter and only one-half inch wide, operating at 4540 rpm. This figure would soar to astronomical numbers computing cutting edges in a wheel of similar size, but utilizing finer abrasive grain.

Electrolytic Shaping Systems

Announcement of the formation of Anocut Engineering Co. has been made by officers of the firm, which has been engaged since the first of the year in the development and manufacture of equipment for automatic electronic control of electrolytic shaping systems.

Only recently emerged from the laboratory stages, electrolytic shaping has been responsible for drastic reduction in the cost of grinding and working with such hard to grind materials as the carbides, titanium, alloy steels and the new "honeycomb" materials recently introduced to the aircraft industry.

Anocut's executive offices are in room 2300, Board of Trade Building, Chicago, and maintains laboratory and manufacturing facilities at 631 W. Washington Blvd., Chicago.

Norton Address Change

The Los Angeles district office of Norton Co. has moved to 5905 Pacific Blvd., Huntington Park, Calif., from the old headquarters at 4809 S. Alameda St., Los Angeles. Robert W. Cushman is the company's west coast district manager.

Sundstrand Open New Plant

Sundstrand Machine Tool Co. recently completed an addition to its machine tool division facilities. This new plant, located at Belvedere, Ill., is of high bay construction and will be used primarily for the assembly of the larger models of standard Rigidmils. This new unit adds approximately 29,000 square feet to the company's facilities.

Boyar-Schultz Corp. Moves

The Boyar-Schultz Corp. has a new address at 2000 S. 25th Ave., Broadview, Ill. The former address was 2110 Walnut St., Chicago.

CLIPPER
PRECISION DIAMOND TOOLS
Industrial Diamonds
Thread Grinders
Turning Tools
Engraving Tools
Dressing Tools
Diamond Powder

Manufacturers of
DIAMOND TOOLS
and
WHEELS

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CLEVELAND, BILL WIESE, 3030 Euclid Ave.
DETROIT, FLOYD BEARSS, 1433 Northwood Blvd., Royal Oak, Mich.
INDIANAPOLIS, IVAN STRANGE, 33 Tyler Ave., Greenfield, Ind.
KANSAS CITY, MO., PENSINGER'S, 1609 Oak St.
PHILADELPHIA, H. J. MILLER, Valley Brook Rd. and Glen Mawr Dr., Ambler, Pa.
ROANOKE, VA., GEO. H. JACQUES, P.O. Box 311
ROCHESTER, N.Y., DON GINEGAW, 60 Overbrook Rd.
SYRACUSE, N.Y., BARNES & JORDAN, INC., 409 E. Jefferson St.
Representatives in Principal Cities
CLIPPER DIAMOND TOOL CO., INC.
Encircle No. 283 on card opposite Page 86

Stewart L. Wolf

Donald A. Kilb

Leslie L. Andrus

Revis L. Stephenson

Robert D. Lawson

Promotions & Appointments

Stewart L. Wolf has been appointed sales manager, Grinding and Polishing Machinery Corp., Indianapolis, Ind. He recently completed 10 years service in the engineering and sales departments of the Coated Products Division of the Carborundum Co.

Machinery Associates, Inc., of Wynnewood Penn., has been appointed exclusive representative in Washington, D.C., for the grinding Machine Division of Norton Co., Worcester, Mass.

They will continue to represent Norton in the Philadelphia area. Under the new arrangement they will handle both commercial and U.S. government business in the capital.

Three new men were elected to the board of directors of American Wheelabrator & Equipment Corp., Mishawaka, Ind., at the annual stockholders meeting. They are: **Leslie L. Andrus,** vice-president of the corporation and executive head of its dust & fume control division; **Harold M. Miller,** vice-president; and **Ray P. Whitman,** first vice-president of Bell Aircraft Corp., Buffalo, N.Y. **Verne E. Minich,** founder of the corporation, remains chairman of the 15-man board.

Revis L. Stephenson, vice-president of the U. S. Hoffman Machinery Corp., New York, was elected a director of the company, according to a joint announcement by William L. Pfeiffer, Chairman of the board, and Hyman Marcus, president of the company.

Appointment of **Donald D. Gulling** as equipment sales manager of the industrial division of Lempco Products, Inc., Bedford and New Lexington, O., has been announced.

Norton Company stockholders and directors named five new officers and one director at the 70th annual meeting. Two retirements—one a director, the other an officer—were also announced.

Edwin E. McConnell of Worcester was elected treasurer succeeding **William J. Magee,** also of Worcester, who has retired. Mr. McConnell was controller from 1941 and a director since 1951.

William H. Perks was appointed controller to succeed Mr. McConnell and also elected a director, replacing Mr. Magee on the board.

Robert D. Lawson was elected to the new position of vice-president and sales manager of the company's Grinding Machine Division.

Tough grinding jobs?

Check *Vulcanaire* high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

Major Vulcan Services

Engineering, Processing, Designing and Building... Special Tools... Dies ... Special Machines ... Vulcamatic Transfer Machines ... Automation ... including the Vulcan Hydraulics that Form, Pierce, Assemble and size. ... Vulcanaire Jig Grinders ... Motorized Rotary Tables ... Plastic Tooling.

VULCAN TOOL CO.

710 PRITZ STREET • DAYTON 10, OHIO

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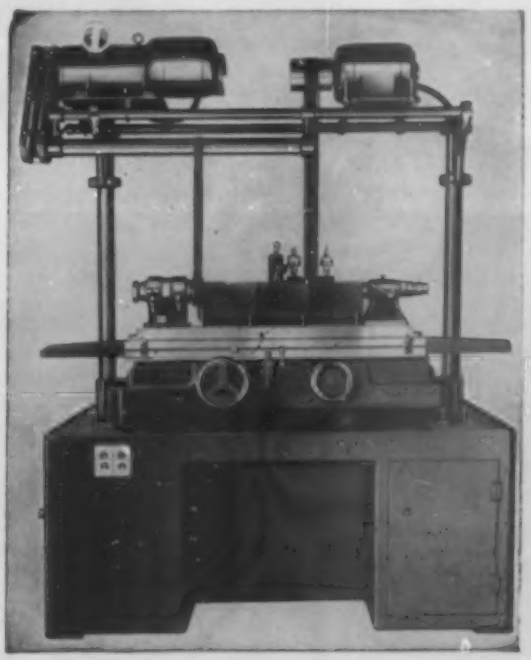
WHY AN OVERHEAD DRIVE?

When purchasing a Grinder you want roundness from .000005 to .000020, a finish from One to Five R.M.S. with immediate spark-out for fast production and ability to hold size from .0001 to .000010.

In order to accomplish this CRYSTAL LAKE uses double taper cone bearings that are pulled into solid bronze boxes.

CRYSTAL LAKE introduced their One R.M.S. Grinder in 1936 featuring their separate motor drive, eliminating cine-wave and providing ample power as a motor larger than wheel head can be used. To produce a One R.M.S. a heavy oil drag has to be placed on bearings. When a spindle is round and held tight in solid boxes, sizing is easy. Spindle, if necessary, can be stopped for measuring of small work, as motor recoil is taken up by springs on hinged motor plate.



As an example of the advantages of the overhead drive, we use our No. 1018 Universal Grinder which is equipped with a 2 horse power motor mounted overhead driving the wheel head spindle ninety degrees from grinding wheel pressure which keeps the bearings round and doubles their life. A one horse power drag is placed on a 2⅛" Diameter spindle so wheel will have to cut round. Bearings can be adjusted from time to time by using Dial Indicator to set end play.

Along with the two horse power on the Wheel Spindle a ¾ h.p. Speedranger is used on the Headstock so a ⅓ h.p. drag can be placed on double taper headstock bearings. Headstock will grind round from .000005" up.

Table can be moved easily as several hundred pounds are taken off table by this mounting.

Write for literature

CRYSTAL LAKE GRINDERS

Since 1910

CRYSTAL LAKE, ILLINOIS

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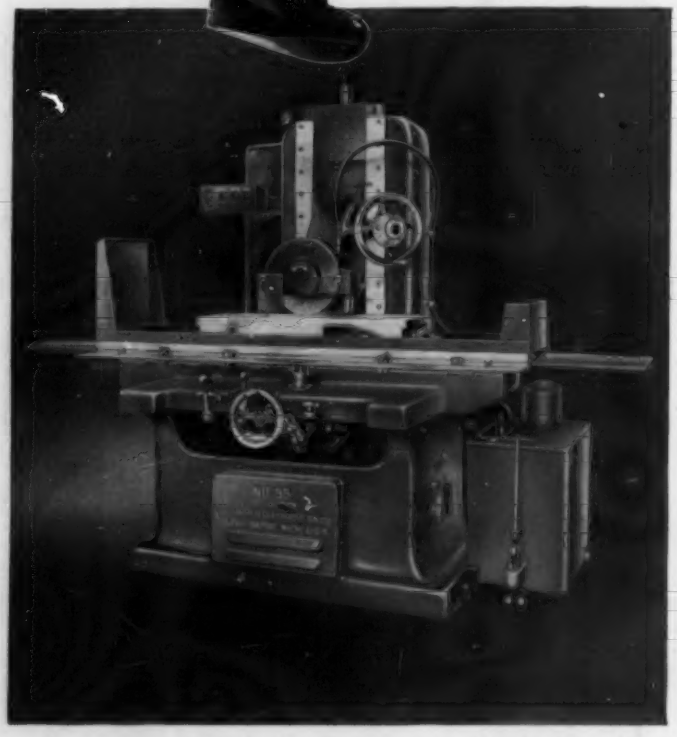
FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

GRAND RAPIDS GRINDERS



Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . depends on them for the uncompromising precision on which records and reputations are made.

Grand Rapids Grinders are engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

That's why so many tool room men insist on Grand Rapids Grinders.

BEECH
BELL
BOEING
CHANCE VOUGHT
DOUGLAS
GRUMMAN
LOCKHEED
MARTIN
McDONNELL
NORTHROP
REPUBLIC

GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER
This precision tool room type machine has table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

Just a note on your letterhead will bring you full details.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY 416 Straight Ave., S.W., Grand Rapids, Michigan

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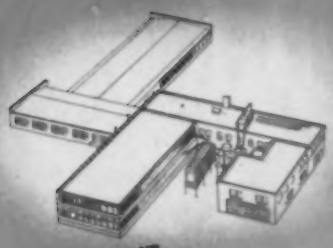
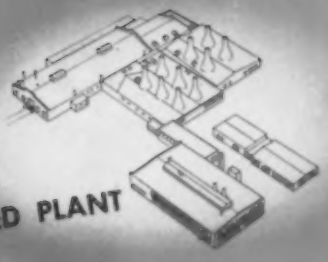
TWO MODERN PLANTS

Guarantee Highest Quality And Quick Delivery On

PENINSULAR GRINDING WHEELS



• RESINOID PLANT



• VITRIFIED PLANT

Back of the faster deliveries and better, more efficient results you obtain from Peninsular grinding wheels are the services provided by *two* modern abrasives plants.

Peninsular vitrified grinding wheels are produced in one plant, resinoid grinding wheels in another . . . both in Detroit, Michigan. These entirely separate facilities make available two manufacturing units, each with its own technical staff, modern production and shipping facilities. From start to finish, each plant contributes a flexible flow that naturally results in more attention being paid to the "little things" that solve your grinding problems.

Add to the greater efficiency and capabilities of Peninsular's *two* plants, the experience gained from more than sixty years of steady devotion to particular types of grinding assignments, and the reasons for Peninsular's superiority are readily apparent.

Take advantage of the individual service and finer quality produced by these two plants. Ask for the services of a Peninsular engineer today—no obligation, of course!

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Shortens your minutes when ordering. It's free . . . ask for it today. Address Department H.

PENINSULAR SINCE 1899

THE PENINSULAR GRINDING WHEEL DIVISION

OF ABRASIVE AND METAL PRODUCTS CO.

DETROIT, MICHIGAN

A&MP COMPANY

Engineered for industry...

3 COMPLETE LINES OF ABRASIVE GRAIN

As the world's largest producer of crude and manufactured abrasive grains, CARBORUNDUM offers you three complete lines of grains, powders, and finishing compounds for metal polishing. Each type of grain is expertly *engineered* with as much skill and care as any production tool, to perform a specific job better, faster ... at lower cost.

CALL YOUR CARBORUNDUM DISTRIBUTOR or salesman (listed in the yellow pages of your phone book under "Abrasives" or "Grinding Wheels"). He's qualified to give you expert counsel on any polishing problem ...and he's completely stocked to give you prompt service on your requirements.

FREE BOOKLETS! To help you identify, select and use the proper abrasive grain and powders, ask for Booklet 14. For up-to-date information on lapping and finishing operations, ask for Booklet 13. Both are illustrated, give specific recommendations for use. Write The Carborundum Company, Dept. GF 83-52, Niagara Falls, New York.

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REGISTERED TRADE MARK

...continually putting more **SENSE** *in your abrasive* **DOLLAR**